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CORRELATIVE MEASUREMENT OPPORTUNITIES BETWEEN ATLAS-1 AND UARS EXPERIMENTS

Edwin F. Harrison, Fred M. Denn, and Gary G. Gibson

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Langley Research Center
Hampton, Virginia 23665-5225

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by

Edwin F. Harrison*, Fred M. Denn†, and Gary G. Gibson†

SUMMARY

The first ATmospheric Laboratory for Applications and Science (ATLAS-1) mission was flown aboard the Space Shuttle from March 24 to April 2, 1992. The ATLAS-1 instruments provided a large number of measurements which were coincident with observations from experiments on the Upper Atmosphere Research Satellite (UARS). During the ATLAS-1 mission, simulations were performed to predict when and where coincident measurements between ATLAS-1 and UARS instruments would occur. These predictions were used to develop instrument operation schedules to maximize the correlative opportunities between the two satellites. Results of the simulations provide valuable information for ATLAS and UARS scientists to compare coincident measurements between various instruments on the two satellites.

INTRODUCTION

A major goal of the ATLAS program (Torr and Sullivan, 1992) is to achieve underflights of the UARS to obtain correlative measurements between the two missions. The UARS (Reber, 1990), launched on September 12, 1991, carries a variety of scientific instrumentation for studying the composition and dynamics of the atmosphere. Several UARS instruments are making global measurements of the vertical distributions of ozone, methane, water vapor, and several minor species involved in the chemistry of the ozone layer. The ATLAS is a Shuttle mission designed to be flown about once per year during an 11-year solar cycle to obtain extensive observations of the Sun and the Earth's atmosphere. The combination of the results from the UARS and the complementary atmospheric measurements from ATLAS experiments will greatly advance the understanding of the chemistry of the upper atmosphere. Maximum use of the two satellite data sets will be provided when coincident measurements are obtained.

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*Atmospheric Sciences Division, NASA Langley Research Center, Hampton, VA 23665-5225

†Lockheed Engineering and Sciences Company, Hampton, VA 23666

ORBITAL AND INSTRUMENT SIMULATIONS

Computer simulations of satellite orbital characteristics and sensor techniques were developed to determine time and space coverage capabilities for the various experiments on the two satellites (Harrison and Gibson, 1981). First-order orbital perturbations were included to take into account Earth's nonsymmetrical gravitational field and the motion of the Earth with respect to the Sun (Brooks, 1977). Coincident measurement opportunities between sensors on the two spacecraft are determined by comparing the coverage of pairs of instruments (Harrison et al., 1990).

UPPER ATMOSPHERE RESEARCH SATELLITE (UARS)

The UARS orbital elements are given in Table 1. These elements are based on orbital data supplied after the UARS yaw maneuver and orbit adjust burn on March 23, 1992. The UARS orbit was updated on March 26. Four UARS instruments are simulated: the Halogen Occultation Experiment (HALOE), Microwave Limb Sounder (MLS), Cryogenic Limb Array Etalon Spectrometer (CLAES), and Improved Stratospheric and Mesospheric Sounder (ISAMS). The HALOE is a solar occultation instrument. The MLS and CLAES are limb scanners mounted at a fixed azimuth (90°) on the spacecraft. The UARS flight direction (backward or forward) determines which way the MLS and CLAES view with respect to the velocity vector. They always look toward the dark side of the spacecraft. For our simulations, MLS and CLAES are the same. The ISAMS is also a limb-viewing sensor, but can be programmed to look out either side of the spacecraft. The ISAMS was not operating at the beginning of the ATLAS mission, but did resume taking data on March 27, 1992. A summary of instrument viewing characteristics used in the simulations is given in Table 2.

To aid in visualizing the coverage of the various UARS instruments, Figure 1a shows the geographical distribution of HALOE occultation tangent points, and Figure 1b gives a latitudinal history of HALOE coverage for the ATLAS-1 mission time frame. Figure 2 gives similar data for MLS and CLAES. This coverage also applies to the ISAMS instrument whenever it is viewing in the same direction as MLS and CLAES. Figure 3 shows geographical and latitude-temporal coverage for the ISAMS viewing toward the illuminated side of the spacecraft (designated ISAMS-R). The ISAMS-R coverage is shown only after the instrument resumed operation on March 27. All data are for a tangent height of 30 km.

ATMOSPHERIC LABORATORY FOR APPLICATIONS AND SCIENCE (ATLAS-1)

The ATLAS-1 orbital elements are given in Table 1. The ATLAS-1 orbit was updated twice during the mission, and the ATLAS-UARS coincident measurement predictions revised as appropriate. Three ATLAS-1 instruments are simulated: Atmospheric Trace Molecule Spectroscopy (ATMOS), Millimeter-Wave Atmospheric Sounder (MAS), and Shuttle Solar Backscatter UltraViolet (SSBUV). The ATMOS is a solar occultation instrument. There are viewing obstructions at

azimuths within 15° of the spacecraft axis, but this constraint is not included in the simulations. The azimuth angle (beta) is, however, given in the tabular listings of coincident measurements. The Grille spectrometer (GRILLE) also looks at occultations, so that instrument would have the same coverage as the ATMOS. The MAS looks at an azimuth 90° to the velocity vector and, like the MLS and CLAES on the UARS, views toward the dark side of the spacecraft. The MAS was also simulated viewing toward the sunlit side of the spacecraft. This "reverse" viewing option is referred to as the MAS-R. Other instruments such as the Atmospheric Emissions Photometric Imaging (AEPI) and Imaging Spectrometric Observatory (ISO) look at the limb over the same Shuttle wing as the MAS, so MAS results also apply to these instruments. Finally, the SSBUV is simulated as nadir viewing with a restriction that solar zenith angle be 0° to 90°. A summary of instrument viewing characteristics used in the simulations is given in Table 2.

Figure 4a shows plots of ATLAS ATMOS (or GRILLE) occultation tangent points latitude vs. longitude with separate symbols for sunrise and sunset; Figure 4b gives latitude vs. time for this instrument. Figures 5, 6, and 7 show similar plots for the MAS scanner viewing toward the dark side of the ATLAS, for the nadir-viewing SSBUV, and for the MAS-R (viewing toward the sunlit side of the ATLAS), respectively. All limb-viewing data are for a tangent height of 30 km.

ATLAS-UARS CORRELATIVE MEASUREMENTS

Computer programs were developed to compare each ATLAS measurement point for a given instrument with all measurement points of a selected UARS sensor that occur within a specified time interval. For each UARS orbit pass, the closest point meeting both time and distance constraints is determined. For these simulations, each ATLAS instrument was assumed to operate continuously throughout the mission.

Correlative opportunities were determined for the various instrument combinations on the two satellites. A miss time of 3.5 hours was used for all cases. Miss distance was 2000 km for the two occultation instruments (ATMOS vs. HALOE), 500 km for occultation instruments vs. the limb scanners and nadir-viewing sensor, and 200 km for coincident measurements between non-occultation instruments. Plots of latitude vs. longitude and latitude vs. time are presented for the coincident measurements between the ATLAS (ATMOS) and the UARS (HALOE) in Figures 8a and 8b. For these two experiments, there are 148 correlative measurement opportunities. Similar data for the ATMOS vs. MLS/CLAES/ISAMS (93 opportunities) and ATMOS vs. ISAMS-R (14 opportunities) are given in Figures 9 and 10. Coincident measurements between the HALOE and MAS (253 opportunities), HALOE and SSBUV (15 opportunities), and HALOE and MAS-R (89 opportunities) are shown in Figures 11, 12, and 13, respectively. Figure 14 presents the 335 correlative opportunities between the SSBUV and MLS/CLAES/ISAMS, and Figure 15 shows SSBUV vs. ISAMS-R (707 opportunities). Finally, the 1282 coincident opportunities between the MAS and MLS/CLAES/ISAMS are shown in Figure 16.

For each of these combinations, tabular data were generated to fully describe each coincident measurement point. The tabular output includes (for each satellite) the Greenwich Mean Time (GMT), mission elapsed time, satellite latitude and longitude, viewing angles with respect to the spacecraft velocity vector, geographical location of the measurement point, time and distance between the measurement points of the two instruments, and, in some cases, the solar zenith angle at the viewed point. Tabular data are given in Table 3 for the two solar occultation instruments (ATMOS and HALOE). The ATMOS measurements coincident with MLS, CLAES, and ISAMS are presented in Table 4. Note that the ISAMS instrument did not operate until March 27. ATMOS data coincident with the ISAMS-R (ISAMS looking toward the sunlit side of UARS) are given in Table 5. Tables 6, 7, and 8 show coincident measurement results for HALOE compared with MAS, SSBUV, and MAS-R, respectively.

The remaining cases are comparisons between limb scanners or between a limb scanner and the nadir-viewing sensor. These comparisons involve a large volume of data, require considerable computation time, and result in a large number of coincident measurement opportunities. Tabular output for these cases is not included.

CONCLUDING REMARKS

Data are presented to show the correlative measurement opportunities between various experiments on ATLAS-1 and UARS. A large number of such opportunities was available during the ATLAS-1 mission, and these predictions were supplied to mission planners to aid in scheduling instrument operations to maximize correlative data opportunities for the experiment scientists. The results in this report should be useful to scientists in assessing the correlative data available for analysis.

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Torr, Marsha R. and Kathryn D. Sullivan: The ATLAS-1 Shuttle Mission. Eos Transactions, American Geophysical Union, **73**, 105, 1992.

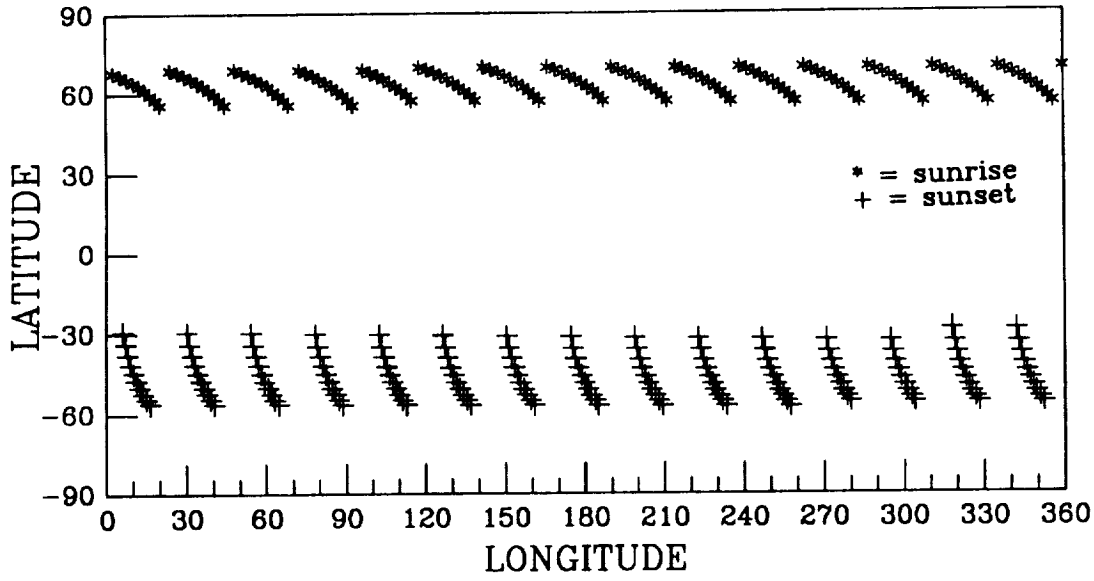

Figure 1a. Geographical distribution of UARS HALOE occultation points.

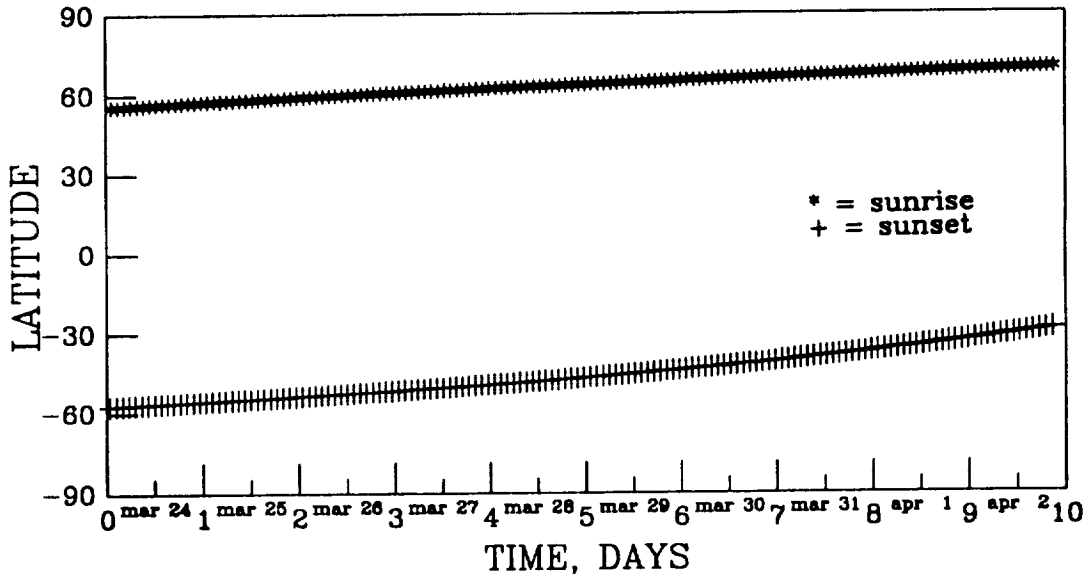

Figure 1b. Latitudinal history of HALOE coverage.

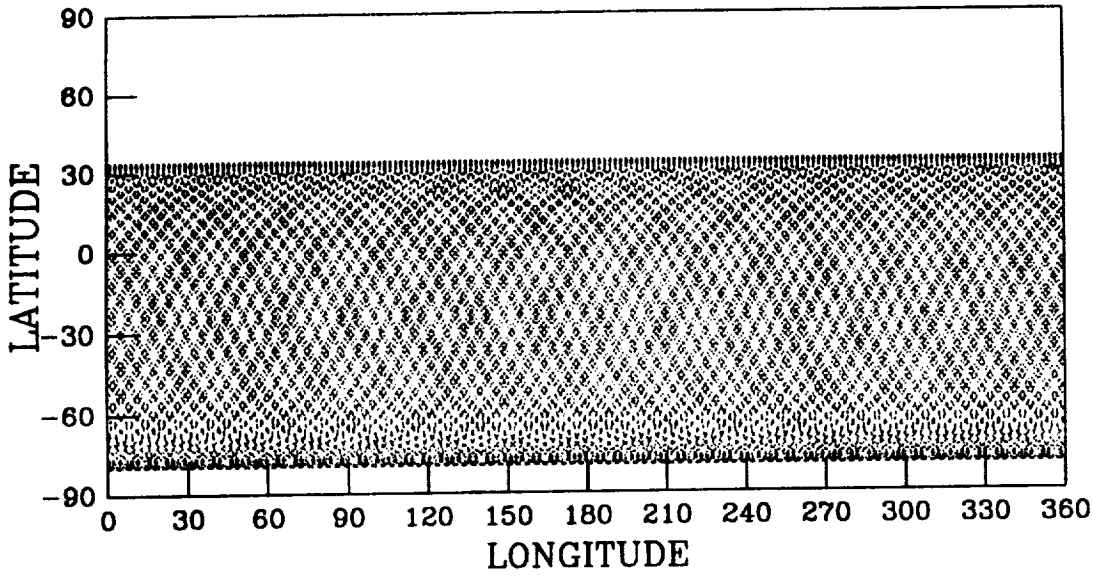

Figure 2a. Geographical distribution of UARS MLS/CLAES/ISAMS scanner points.

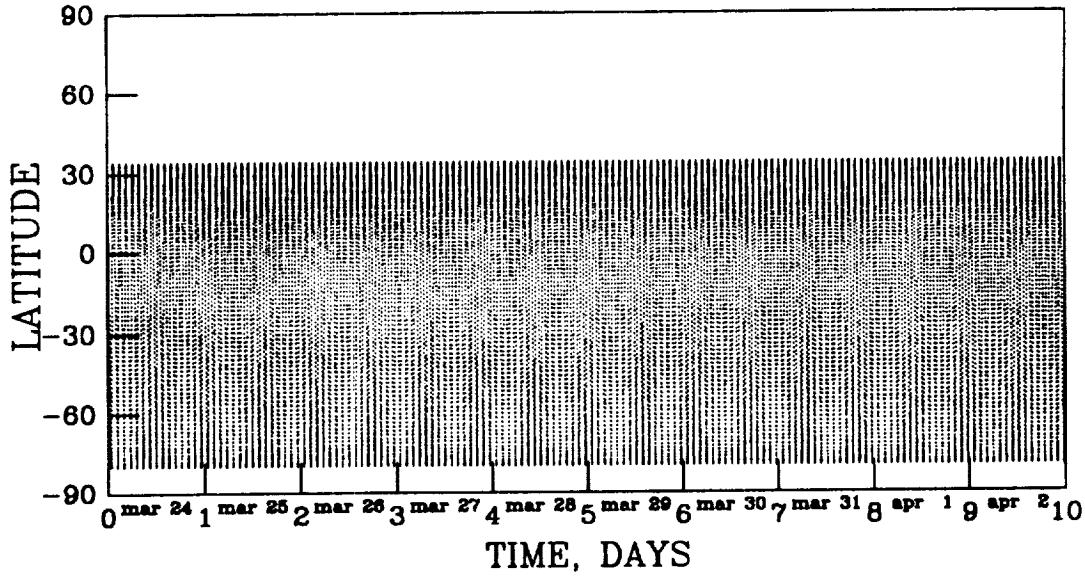

Figure 2b. Latitudinal history of MLS/CLAES/ISAMS coverage.

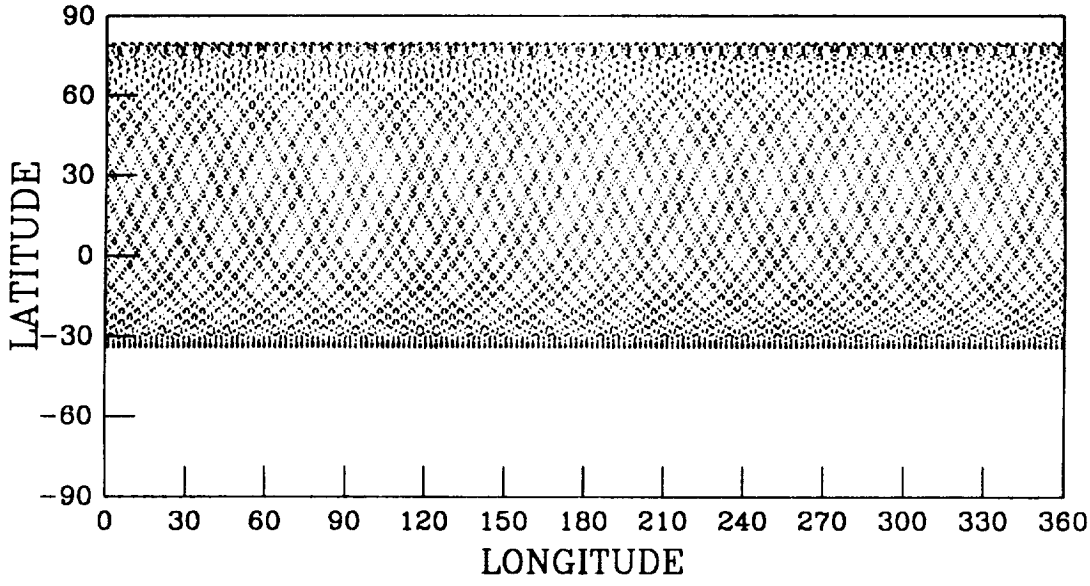

Figure 3a. Geographical distribution of UARS ISAMS-R scanner points.

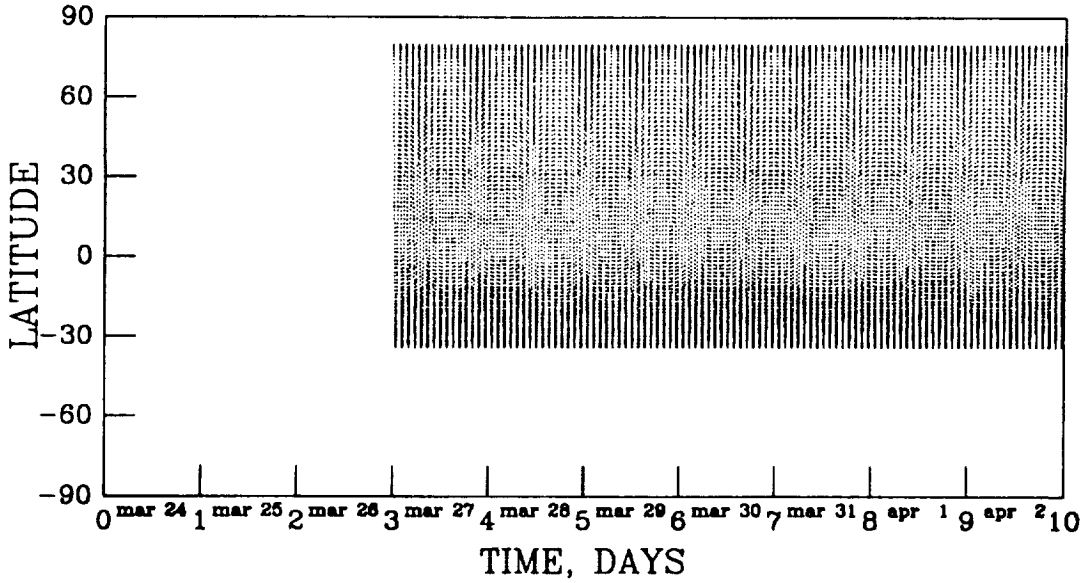

Figure 3b. Latitudinal history of ISAMS-R coverage.

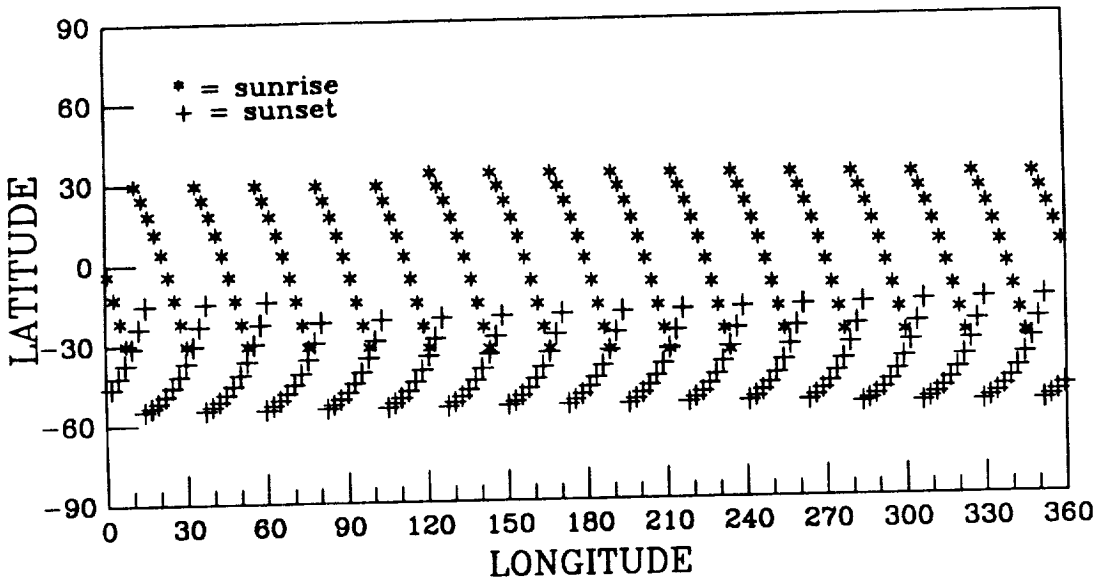

Figure 4a. Geographical distribution of ATLAS ATMOS/GRILLE solar occultation points.

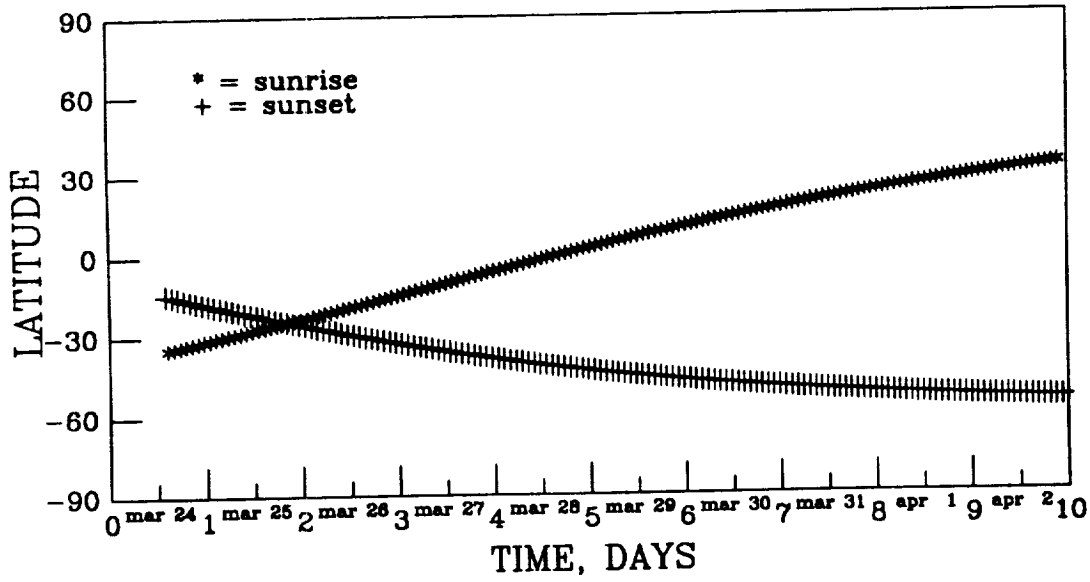

Figure 4b. Latitudinal history of occultation coverage for ATMOS/GRILLE.

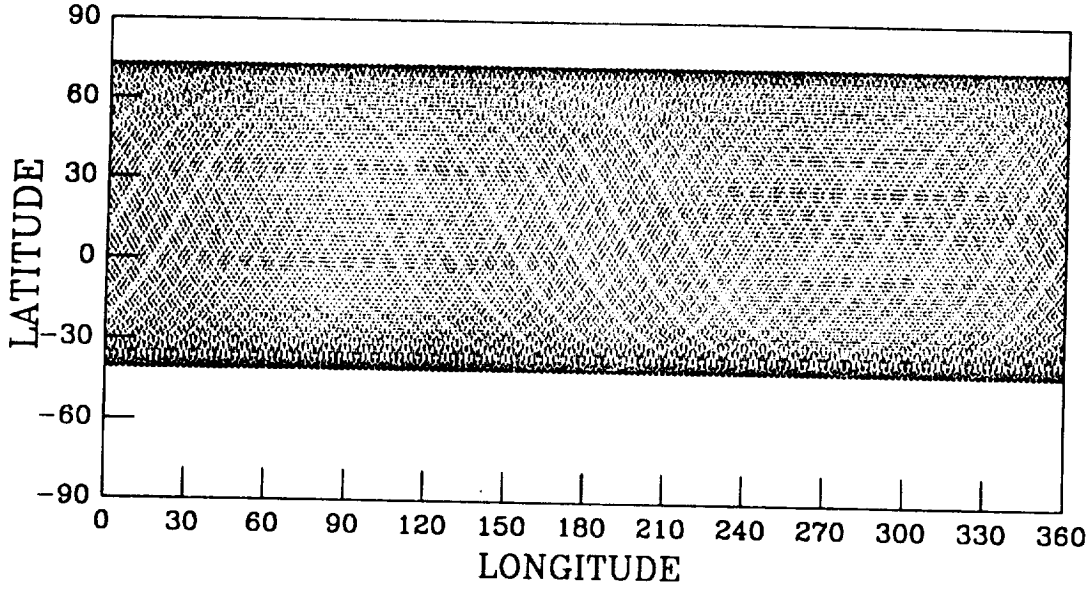

Figure 5a. Geographical distribution of ATLAS MAS scanner points.

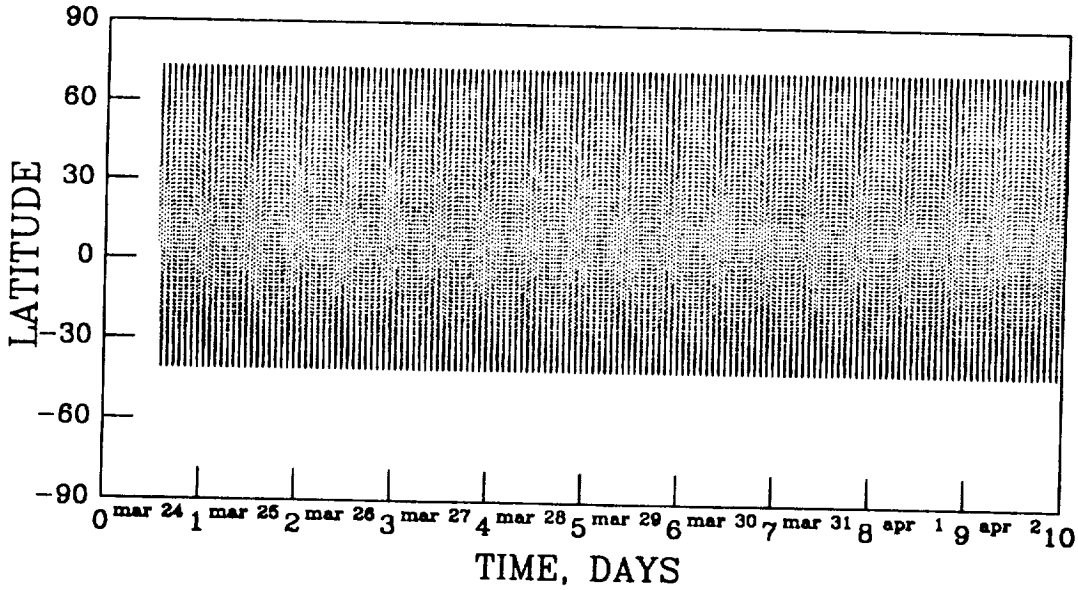

Figure 5b. Latitudinal history of scanner coverage for MAS.

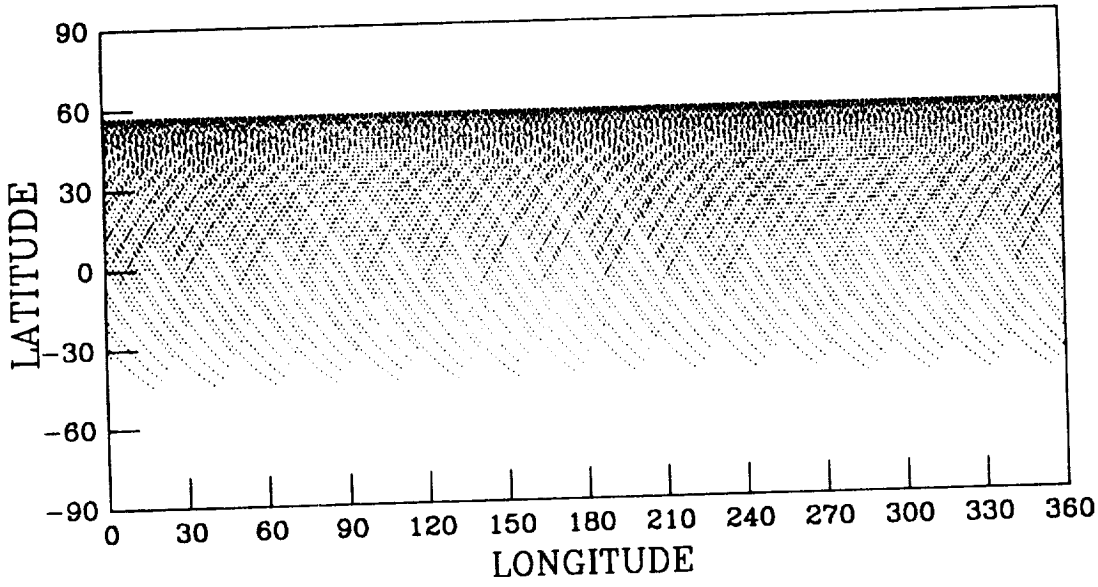

Figure 6a. Geographical distribution of ATLAS SSBUV observed points.

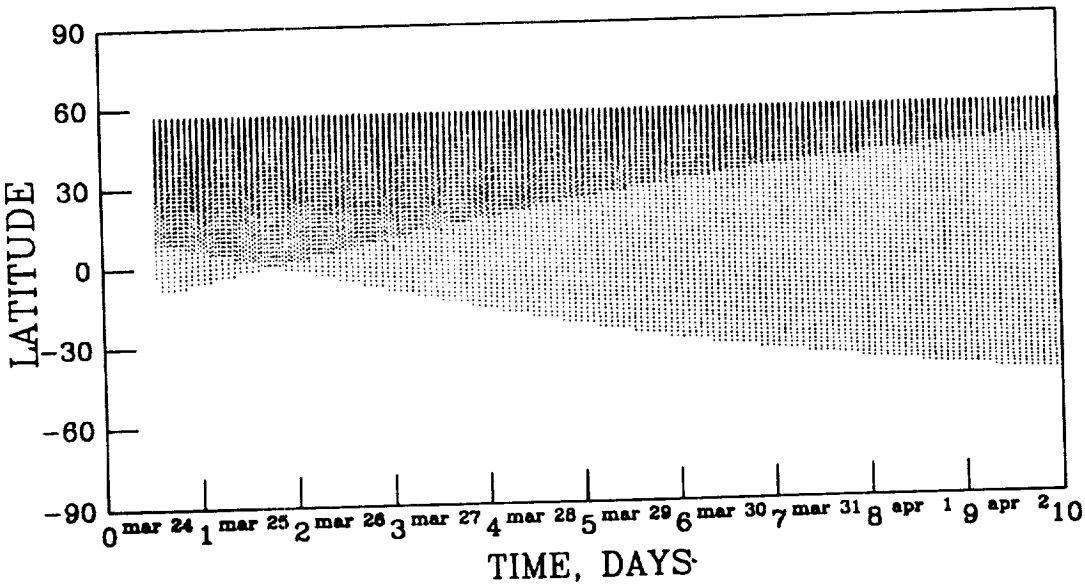

Figure 6b. Latitudinal history of coverage for SSBUV.

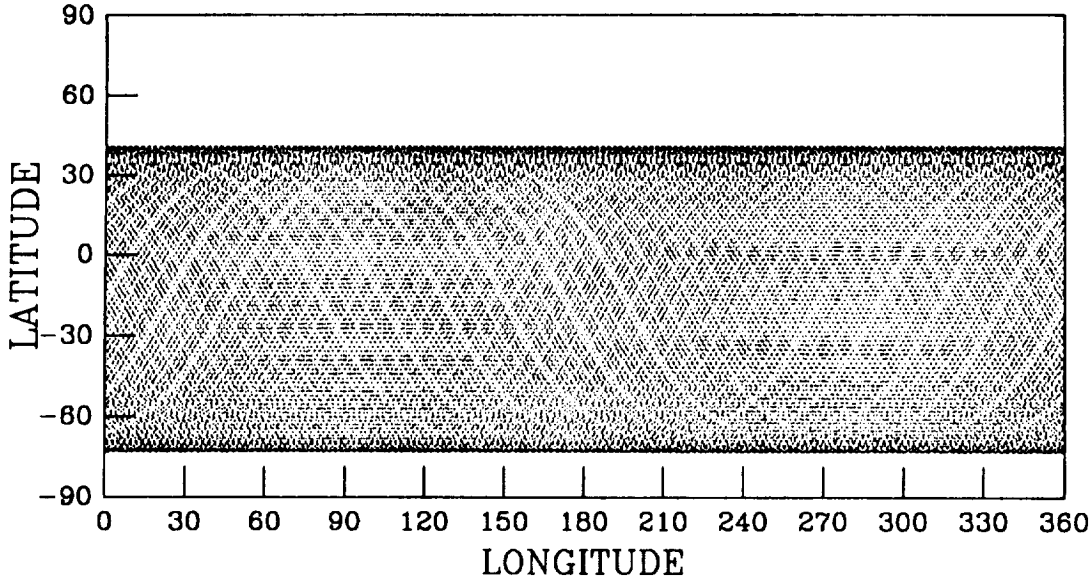

Figure 7a. Geographical distribution of ATLAS MAS-R scanner points.

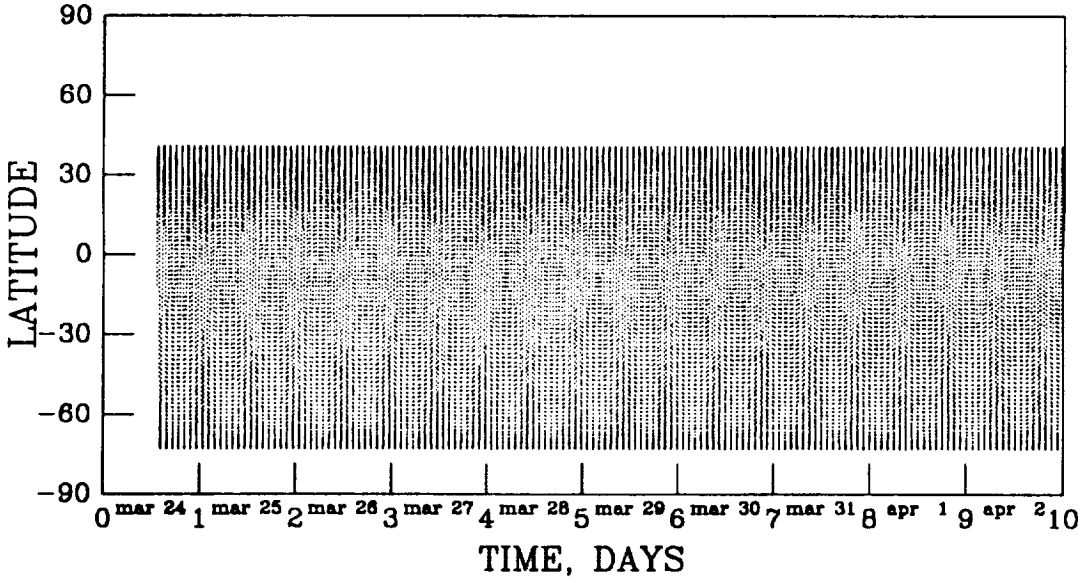

Figure 7b. Latitudinal history of coverage for MAS-R.

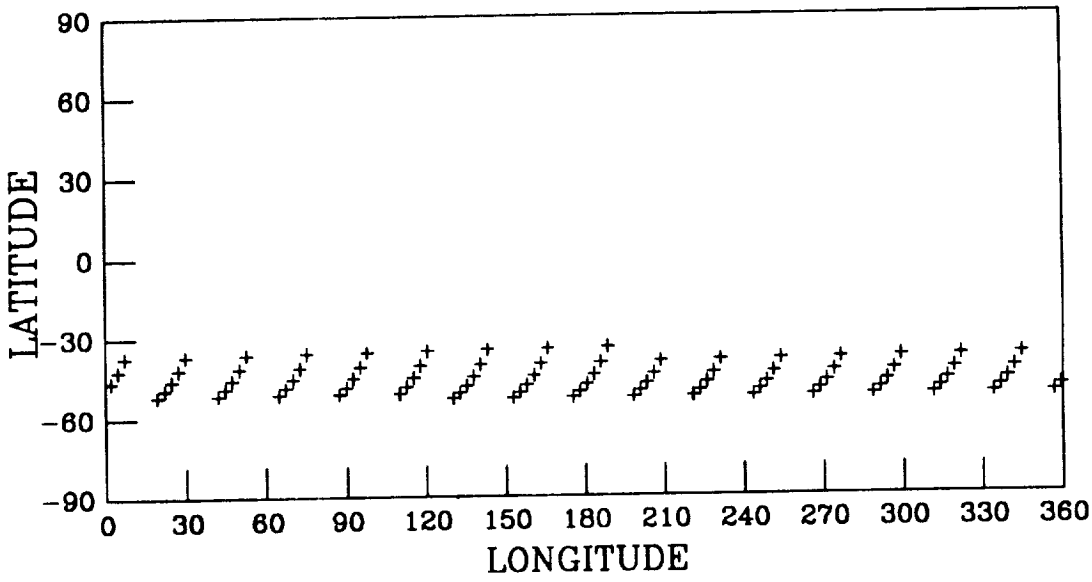

Figure 8a. Geographical coverage of coincident measurement points between ATLAS ATMOS/GRILLE and UARS HALOE.

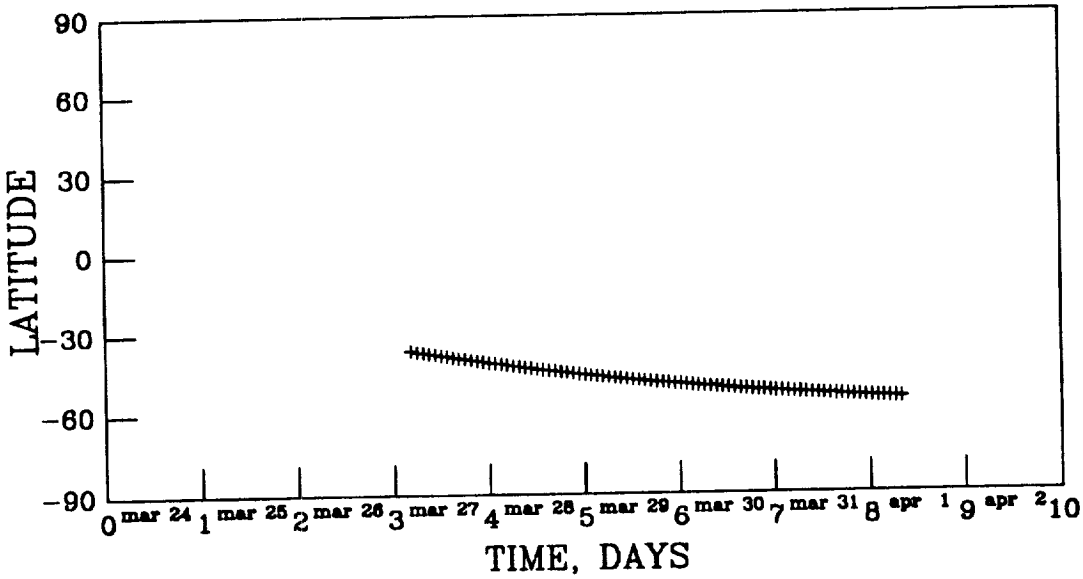

Figure 8b. Latitudinal coverage history of coincident measurement points between ATMOS/GRILLE and HALOE.

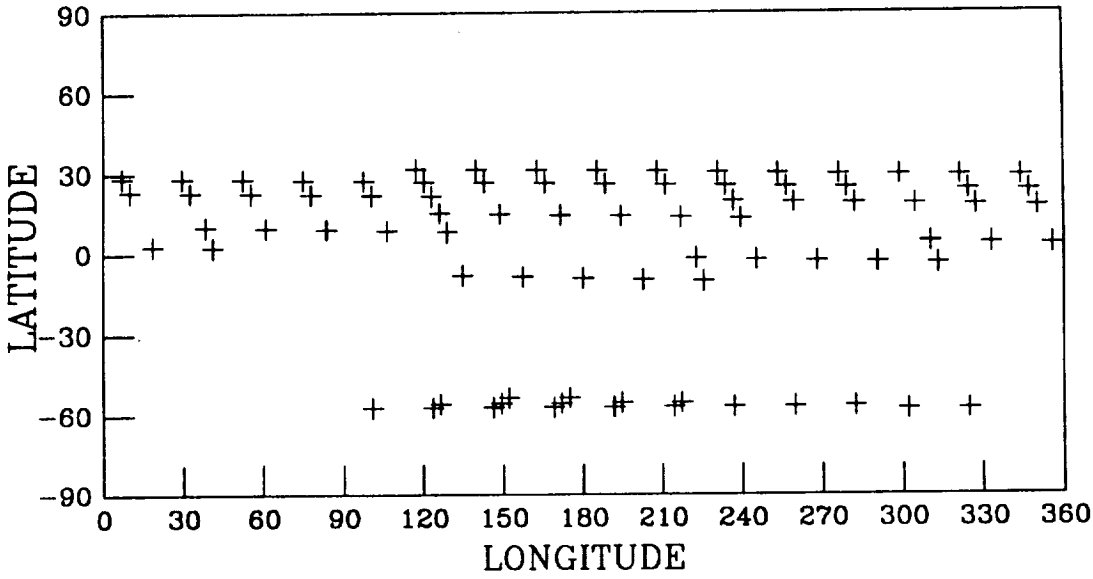

Figure 9a. Geographical coverage of coincident measurement points between ATLAS ATMOS/GRILLE and UARS MLS/CLAES/ISAMS.

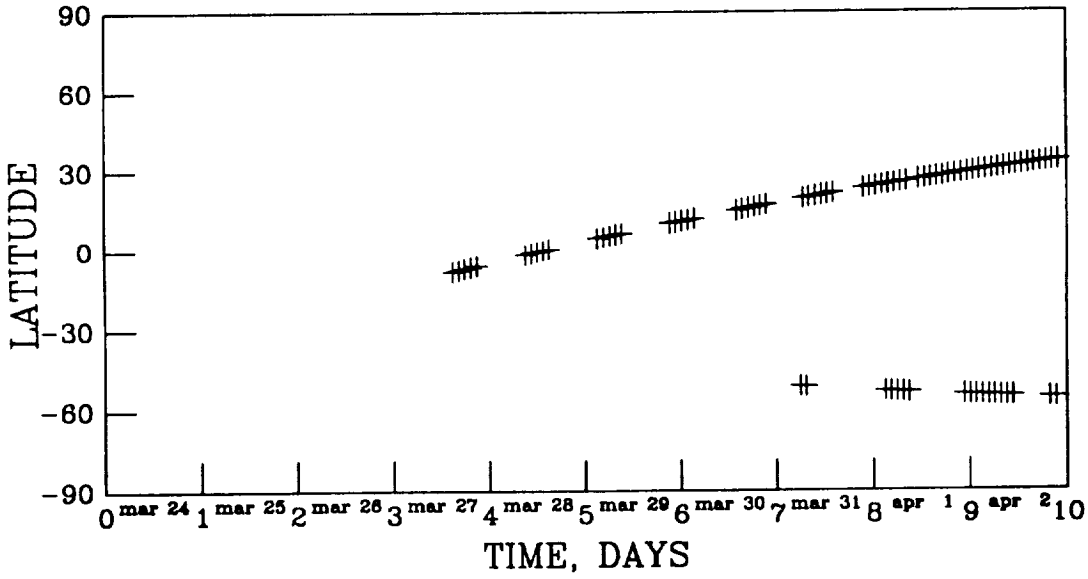

Figure 9b. Latitudinal coverage history of coincident measurement points between ATMOS/GRILLE and MLS/CLAES/ISAMS.

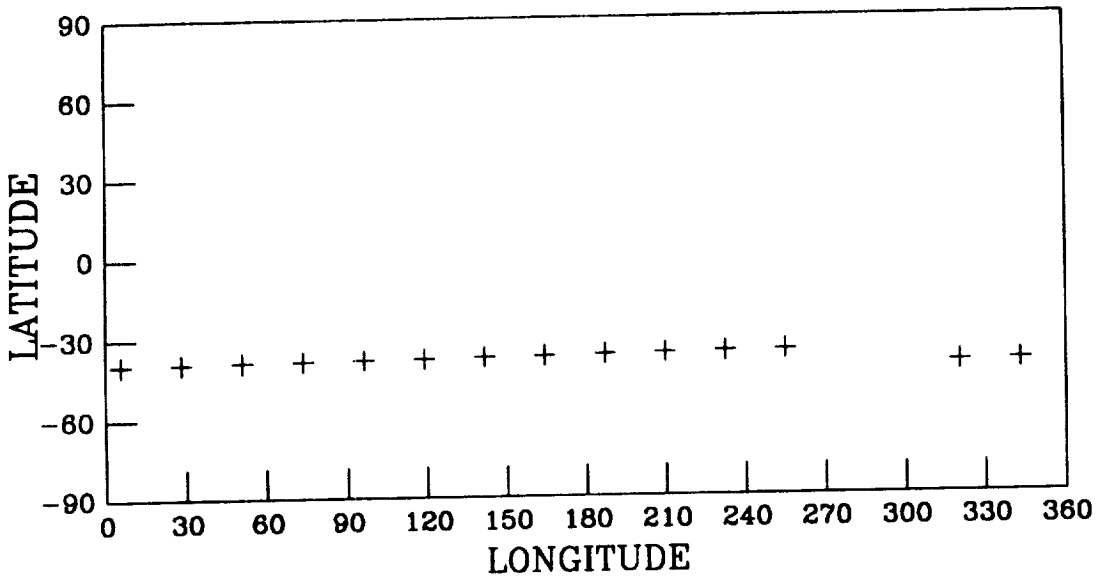

Figure 10a. Geographical coverage of coincident measurement points between ATLAS ATMOS/GRILLE and UARS ISAMS-R.

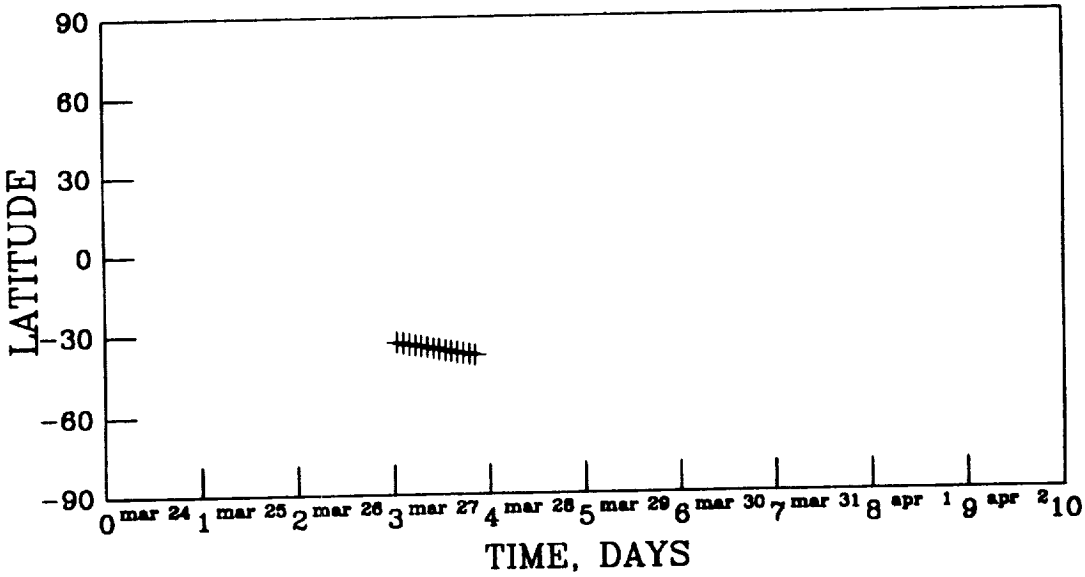

Figure 10b. Latitudinal coverage history of coincident measurement points between ATMOS/GRILLE and ISAMS-R.

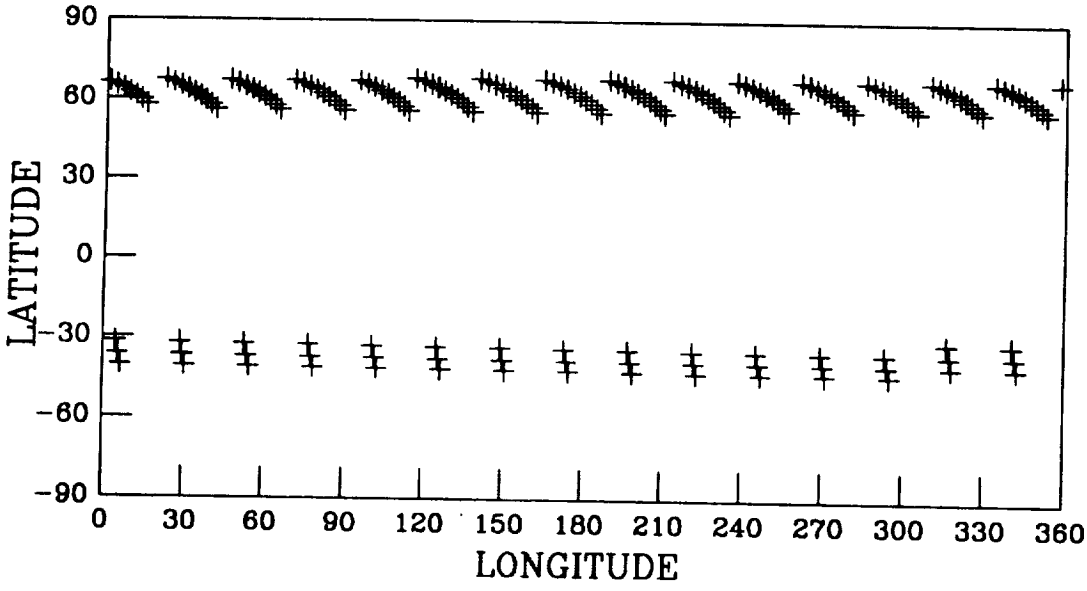

Figure 11a. Geographical coverage of coincident measurement points between UARS HALOE and ATLAS MAS.

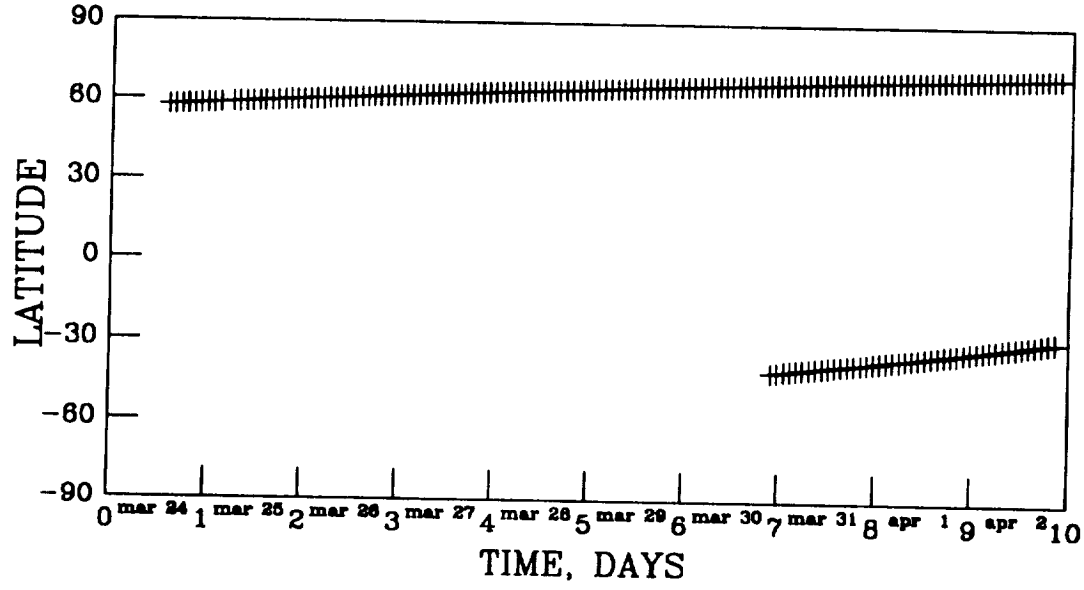

Figure 11b. Latitudinal coverage history of coincident measurement points between HALOE and MAS.

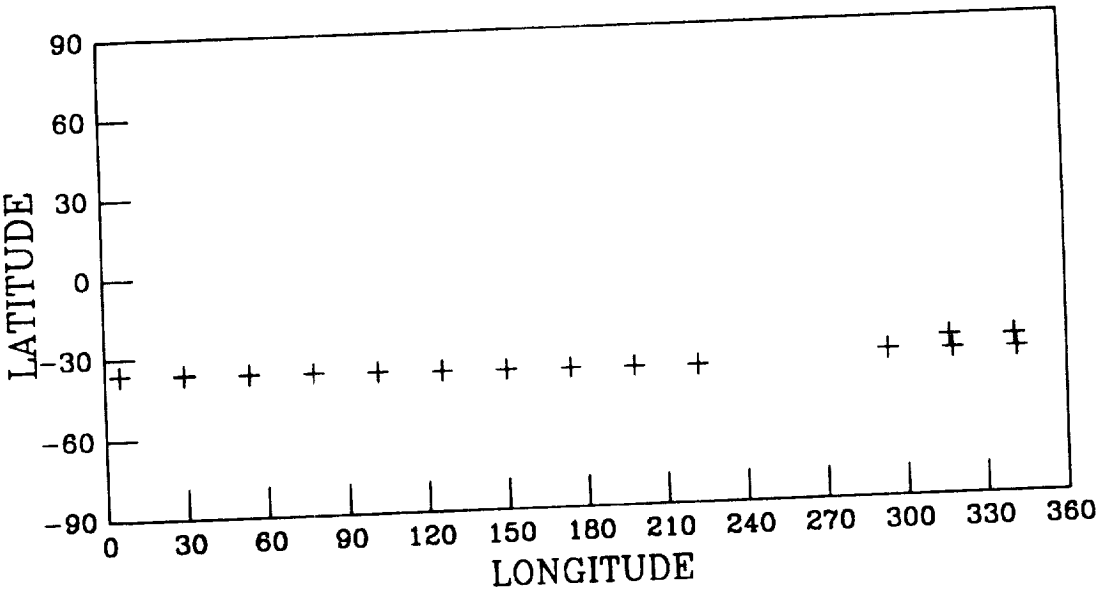

Figure 12a. Geographical coverage of coincident measurement points between UARS HALOE and ATLAS SSBUV.

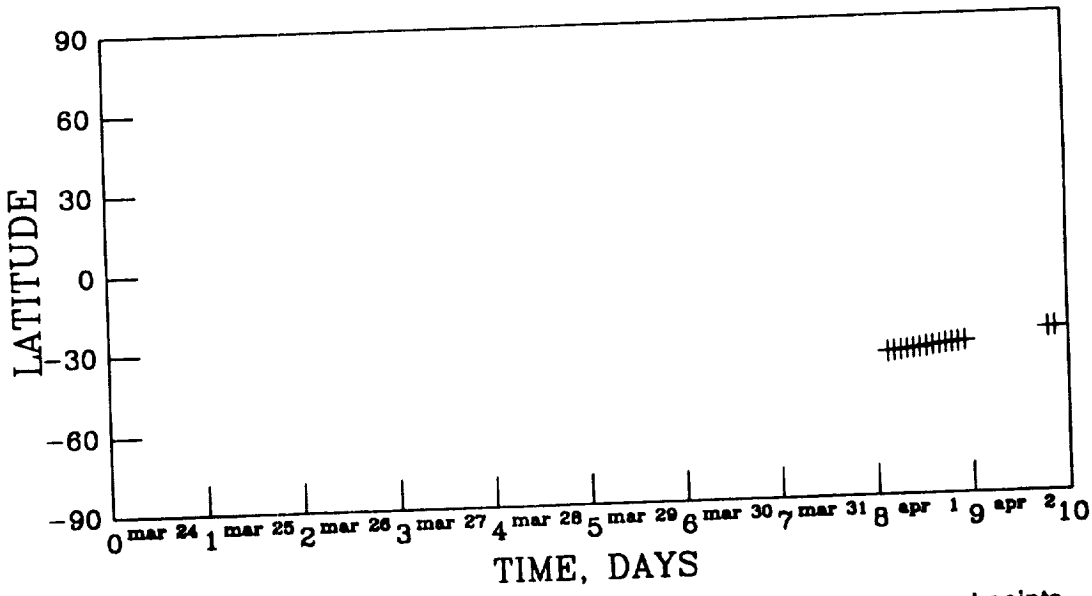

Figure 12b. Latitudinal coverage history of coincident measurement points between HALOE and SSBUV.

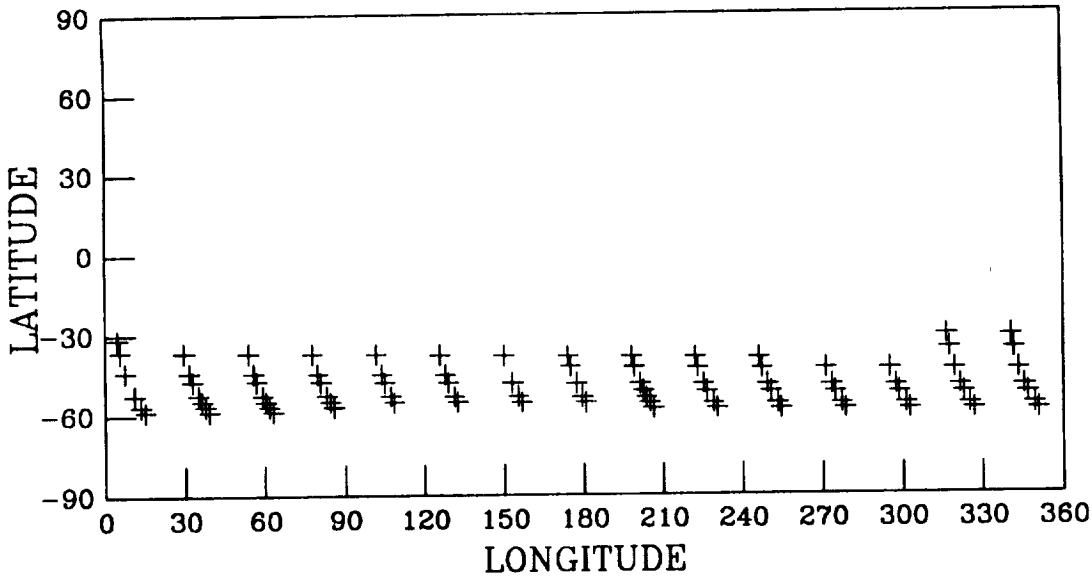

Figure 13a. Geographical coverage of coincident measurement points between UARS HALOE and ATLAS MAS-R.

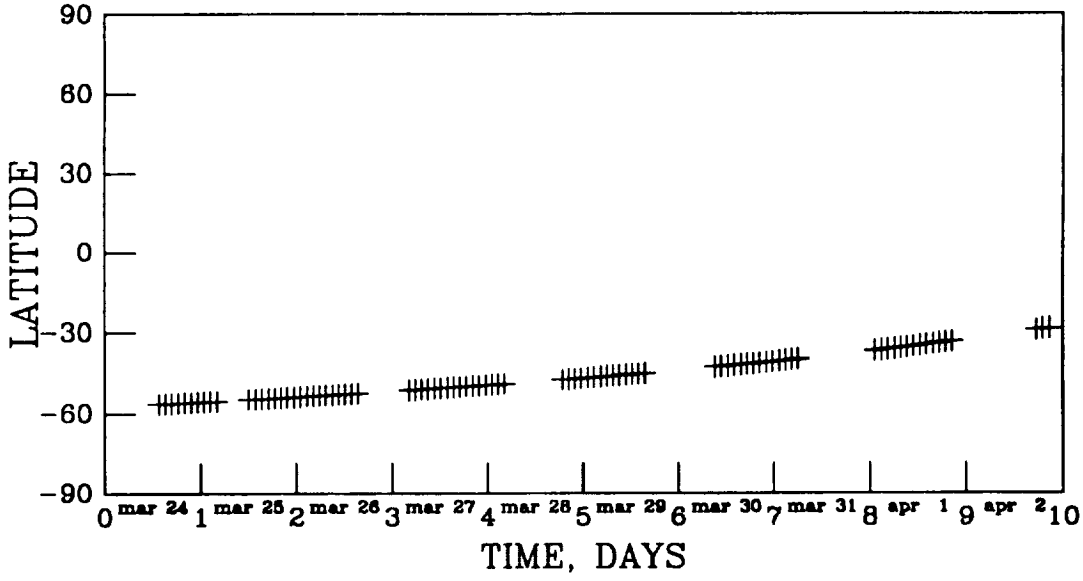

Figure 13b. Latitudinal coverage history of coincident measurement points between HALOE and MAS-R.

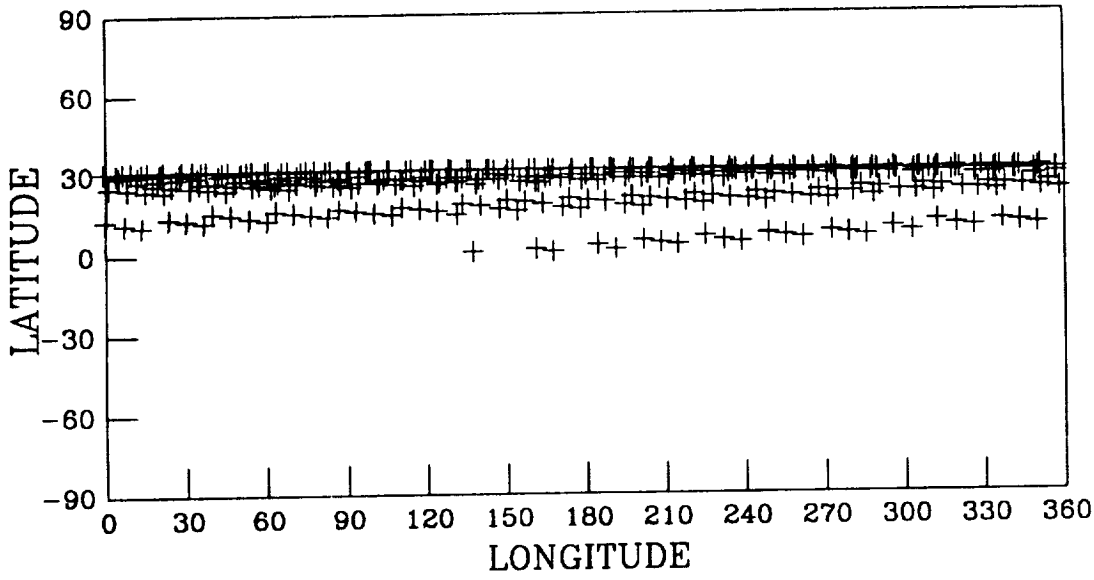

Figure 14a. Geographical coverage of coincident measurement points between ATLAS SSBUV and UARS MLS/CLAES/ISAMS.

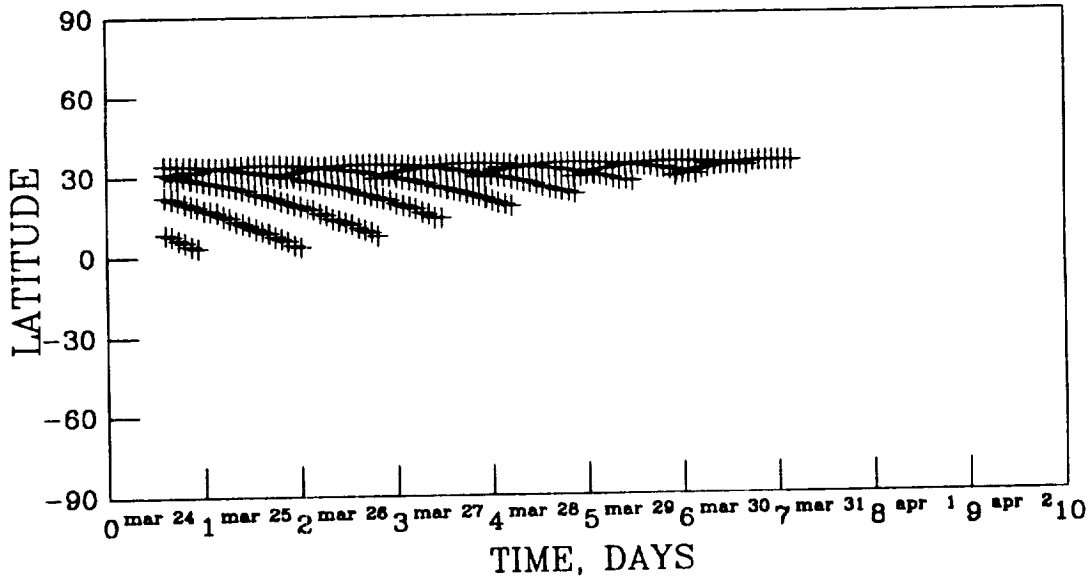

Figure 14b. Latitudinal coverage history of coincident measurement points between SSBUV and MLS/CLAES/ISAMS.

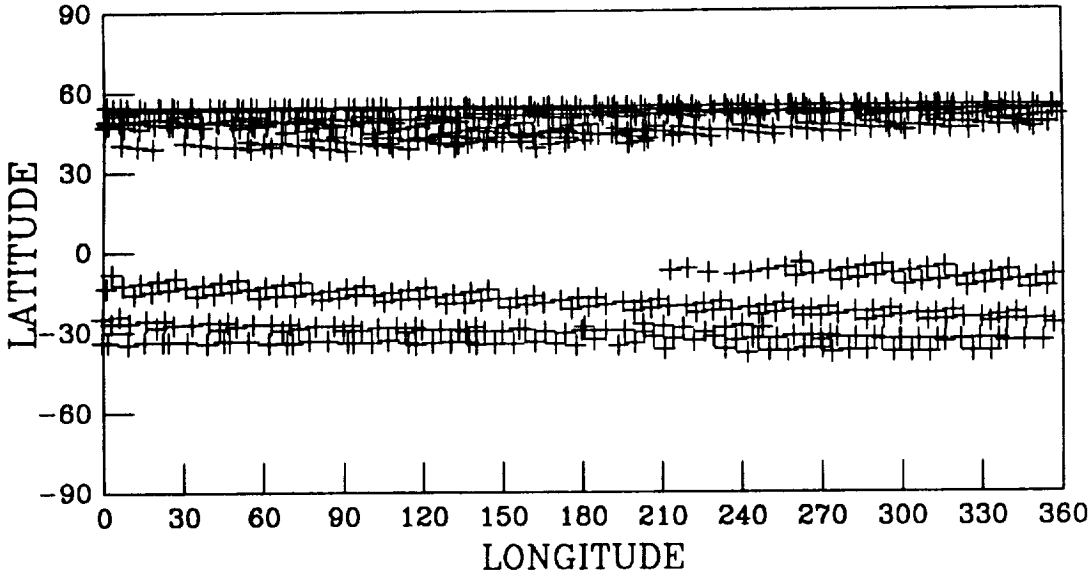

Figure 15a. Geographical coverage of coincident measurement points between ATLAS SSBUV and UARS ISAMS-R.

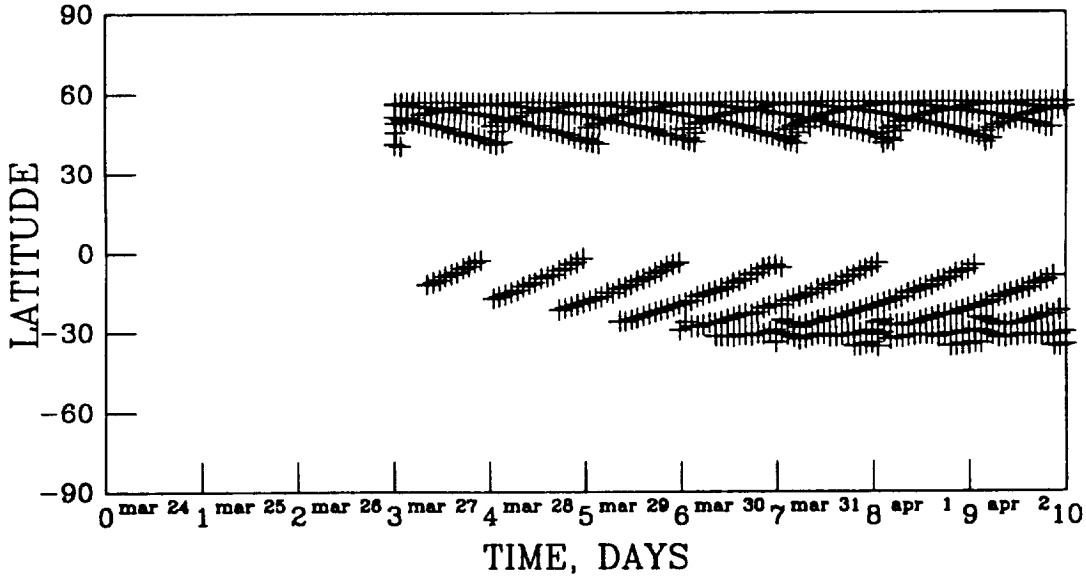

Figure 15b. Latitudinal coverage history of coincident measurement points between SSBUV and ISAMS-R.

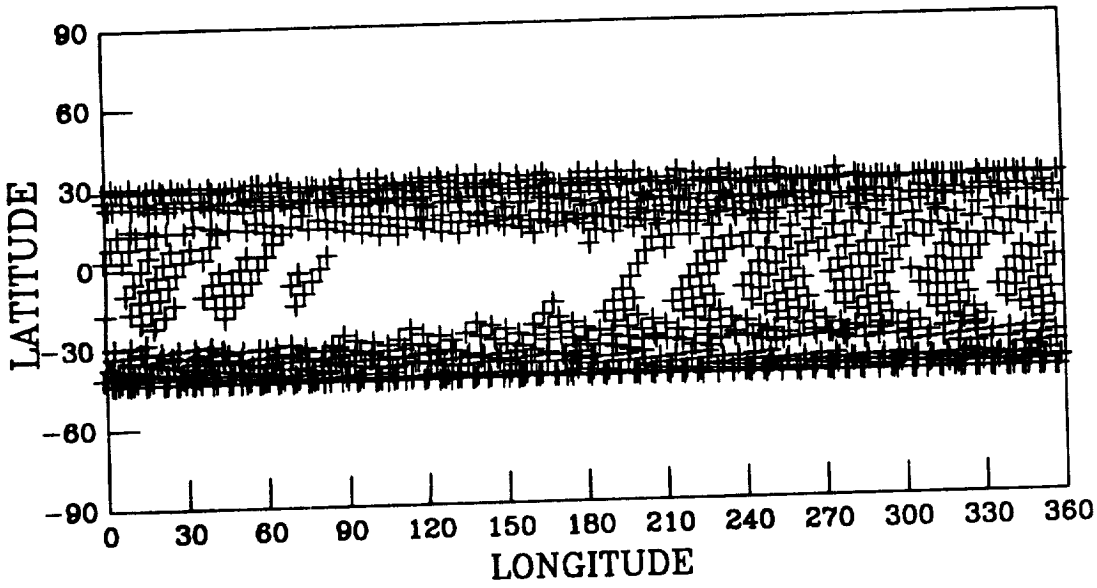

Figure 16a. Geographical coverage of coincident measurement points between ATLAS MAS and UARS MLS/CLAES/ISAMS.

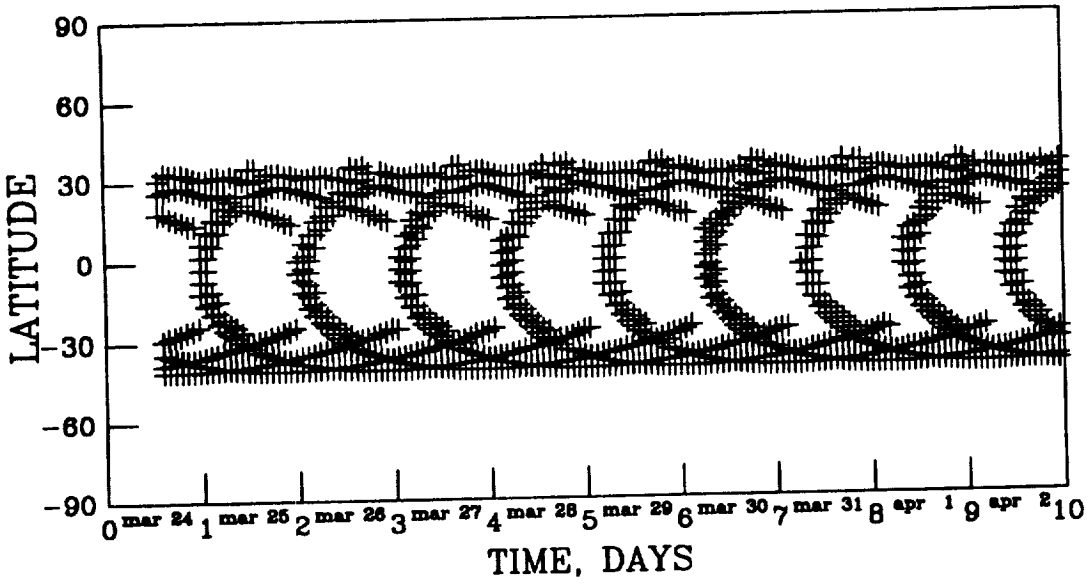

Figure 16b. Latitudinal coverage history of coincident measurement points between MAS and MLS/CLAES/ISAMS.

Table 1. UARS AND ATLAS ORBITAL ELEMENTS.

ORBITAL PARAMETER	SATELLITE				
	UARS[1] (INITIAL)	UARS (UPDATE)	ATLAS-1[2] (INITIAL)	ATLAS-1 (UPDATE 1)	ATLAS-1 (UPDATE 2)
TIME OF STATE VECTOR					
DATE (mo, day, yr)	3-24-92	3-26-92	3-24-92	3-27-92	3-30-92
GMT (hr, min, sec)	10:00:00	10:00:00	17:41:55	6:43:39	6:43:39
ORBIT ELEMENTS[3]					
SEMI-MAJOR AXIS (km)	6956.39	6956.29	6674.717	6673.133	6669.842
INCLINATION (deg)	56.985	56.984	56.998	56.996	56.997
RIGHT ASCENSION (deg)	185.52	185.53	282.92	283.23	283.27
ORBIT ANGLE[4] (deg)	113.00	112.67	92.32	92.76	72.36

[1]UARS was launched on September 12, 1991 at 23:11:04 GMT.

[2]ATLAS was launched on March 24, 1992 at 13:13:40 GMT.

[3]All orbital elements have been adjusted to a common time of 00:00:00 GMT on March 24, 1992. This is done to facilitate the coincident measurement simulations and to evaluate orbital variations during the mission.

[4]Orbit Angle is the orbit central angle between the ascending node and the satellite.

Table 2. UARS AND ATLAS-1 INSTRUMENT VIEWING CONSTRAINTS

UARS			ATLAS-1		
INSTRUMENT	VIEWING AZIMUTH, deg	CONSTRAINTS	INSTRUMENT	VIEWING AZIMUTH, deg	CONSTRAINTS
MLS/CLAES	±90	VIEWS TOWARD DARK SIDE OF EARTH ONLY	MAS	±90	VIEWS TOWARD DARK SIDE OF EARTH
ISAMS	±90	PROGRAMMABLE	SSBUV	NADIR VIEWING	SOLAR ZENITH ANGLE 0°-90°
HALOE	VARIABLE	VIEWS TOWARD SUN SIDE OF SPACECRAFT	ATMOS/GRILLE	VARIABLE	VIEWS TOWARD SUN SIDE OF SPACECRAFT

NOTES: MLS, CLAES, ISAMS, and MAS are all limb-viewing sensors; HALOE and ATMOS look at the Sun at sunrise and sunset of the spacecraft; GRILLE on ATLAS-1 has the same viewing as ATMOS; and SSBUV is a nadir-viewing sensor. For MLS, CLAES, and MAS, the viewing azimuth with respect to the velocity vector depends on whether the spacecraft is flying in a forward or backward orientation. The azimuth (either +90° or -90°) is such that the view is toward the dark side of the spacecraft. ISAMS generally views in the same direction as MLS, but is also capable of viewing toward the sunlit side of the UARS spacecraft. The ISAMS orientation viewing toward the sunlit side is referred to as ISAMS-R. MAS may also be able to view toward the sunlit side of the ATLAS-1 spacecraft if the flight orientation is not as anticipated. The reverse viewing orientation for MAS (looking toward the sunlit side) is referred to as MAS-R.

Table 3. ATLAS ATMOS/GRILLE coincident with UARS HALOE.

sat.	instrument	gmt yr	mo	da	hr	mn	sc	time into mission da	hr	mn	sc	sub satellite lat	lon	viewing angle beta	alpha	observed point lat	lon	miss dist km	time hr	mn
ATLAS	ATMOS/GRILLE	92	3	27	2	23	7	2	13	9	27	-33.3	-106.7	123.0	-16.2	-34.0	-126.2	1969	0	12
UARS	HALOE	92	3	27	2	35	14	196	3	24	10	-47.5	-95.7	-166.5	-22.9	-51.4	-130.8			
ATLAS	ATMOS/GRILLE	92	3	27	3	53	40	2	14	40	0	-33.7	-129.3	123.1	-16.2	-34.4	-148.9	1936	0	17
UARS	HALOE	92	3	27	4	11	30	196	5	0	25	-47.4	-119.9	-166.2	-22.9	-51.2	-154.9			
ATLAS	ATMOS/GRILLE	92	3	27	5	24	13	2	16	10	33	-34.1	-151.9	123.2	-16.2	-34.8	-171.6	1923	0	23
UARS	HALOE	92	3	27	5	47	45	196	6	36	41	-47.4	-144.0	-166.1	-22.9	-51.2	-179.0			
ATLAS	ATMOS/GRILLE	92	3	27	5	24	13	2	16	10	33	-34.1	-151.9	123.2	-16.2	-34.8	-171.6	1908	0	23
UARS	HALOE	92	3	27	5	47	46	196	6	36	42	-47.3	-144.1	-165.9	-22.9	-51.1	-179.0			
ATLAS	ATMOS/GRILLE	92	3	27	6	52	50	2	17	39	10	-34.1	-174.1	123.3	-16.2	-34.7	166.2	1950	0	31
UARS	HALOE	92	3	27	7	24	1	196	8	12	57	-47.2	-168.2	-165.6	-22.9	-50.9	157.0			
ATLAS	ATMOS/GRILLE	92	3	27	8	23	21	2	19	9	41	-34.4	163.3	123.4	-16.2	-35.1	143.6	1942	0	36
UARS	HALOE	92	3	27	9	0	17	196	9	49	13	-47.1	167.6	-165.3	-22.9	-50.7	132.9			
ATLAS	ATMOS/GRILLE	92	3	27	9	53	52	2	20	40	12	-34.8	140.7	123.5	-16.2	-35.5	120.9	1955	0	53
UARS	HALOE	92	3	27	9	0	17	196	9	49	13	-47.1	167.6	-165.3	-22.9	-50.7	132.9			
ATLAS	ATMOS/GRILLE	92	3	27	9	53	52	2	20	40	12	-34.8	140.7	123.5	-16.2	-35.5	120.9	1943	0	42
UARS	HALOE	92	3	27	10	36	33	196	11	25	28	-46.9	143.4	-165.0	-22.9	-50.6	108.8			
ATLAS	ATMOS/GRILLE	92	3	27	11	24	23	2	22	10	43	-35.2	118.1	123.6	-16.2	-35.8	98.2	1850	0	47
UARS	HALOE	92	3	27	10	36	33	196	11	25	28	-46.9	143.4	-165.0	-22.9	-50.6	108.8			
ATLAS	ATMOS/GRILLE	92	3	27	11	24	23	2	22	10	43	-35.2	118.1	123.6	-16.2	-35.8	98.2	1952	0	48
UARS	HALOE	92	3	27	12	12	48	196	13	1	44	-46.8	119.3	-164.6	-22.9	-50.4	84.7			
ATLAS	ATMOS/GRILLE	92	3	27	12	54	54	2	23	41	14	-35.5	95.5	123.7	-16.2	-36.2	75.5	1748	0	42
UARS	HALOE	92	3	27	12	12	48	196	13	1	44	-46.8	119.3	-164.6	-22.9	-50.4	84.7			
ATLAS	ATMOS/GRILLE	92	3	27	12	54	54	2	23	41	14	-35.5	95.5	123.7	-16.2	-36.2	75.5	1969	0	54
UARS	HALOE	92	3	27	13	49	4	196	14	38	0	-46.7	95.1	-164.3	-22.9	-50.3	60.6			
ATLAS	ATMOS/GRILLE	92	3	27	14	25	25	3	1	11	45	-35.9	72.9	123.8	-16.2	-36.6	52.8	1649	0	36
UARS	HALOE	92	3	27	13	49	4	196	14	38	0	-46.7	95.1	-164.3	-22.9	-50.3	60.6			
ATLAS	ATMOS/GRILLE	92	3	27	14	25	25	3	1	11	45	-35.9	72.9	123.8	-16.2	-36.6	52.8	1994	0	59
UARS	HALOE	92	3	27	15	25	20	196	16	14	16	-46.6	70.9	-164.0	-22.9	-50.1	36.6			
ATLAS	ATMOS/GRILLE	92	3	27	15	55	55	3	2	42	15	-36.2	50.4	124.0	-16.2	-36.9	30.2	1555	0	30
UARS	HALOE	92	3	27	15	25	20	196	16	14	16	-46.6	70.9	-164.0	-22.9	-50.1	36.6			
ATLAS	ATMOS/GRILLE	92	3	27	17	26	26	3	4	12	46	-36.6	27.8	124.1	-16.2	-37.3	7.5	1467	0	24
UARS	HALOE	92	3	27	17	1	35	196	17	50	31	-46.5	46.8	-163.7	-22.9	-50.0	12.5			

Table 3. Continued.

sat.	instrument	gmt yr mo da hr mn sc	time into mission da hr mn sc	sub satellite lat lon	viewing angle beta alpha	observed point lat lon	miss dist km	miss time hr mn
ATLAS	ATMOS/GRILLE	92 3 27 18 56 57	3 5 43 16	-36.9 5.2	124.2 -16.2	-37.6 -15.2	1385	0 19
UARS	HALOE	92 3 27 18 37 51	196 19 26 47	-46.3 22.6	-163.4 -22.9	-49.8 -11.6		
ATLAS	ATMOS/GRILLE	92 3 27 20 27 27	3 7 13 47	-37.2 -17.4	124.3 -16.2	-38.0 -37.9	1310	0 13
UARS	HALOE	92 3 27 20 14 7	196 21 3 3	-46.2 -1.6	-163.1 -22.9	-49.6 -35.7		
ATLAS	ATMOS/GRILLE	92 3 27 21 57 57	3 8 44 17	-37.6 -40.0	124.5 -16.2	-38.3 -60.6	1244	0 7
UARS	HALOE	92 3 27 21 50 23	196 22 39 18	-46.1 -25.8	-162.8 -22.9	-49.5 -59.8		
ATLAS	ATMOS/GRILLE	92 3 27 23 28 28	3 10 14 48	-37.9 -62.6	124.6 -16.2	-38.7 -83.2	1188	0 1
UARS	HALOE	92 3 27 23 26 38	197 0 15 34	-46.0 -49.9	-162.4 -22.9	-49.3 -83.8		
ATLAS	ATMOS/GRILLE	92 3 28 0 58 58	3 11 45 18	-38.2 -85.2	124.8 -16.2	-39.0 -105.9	1143	0 3
UARS	HALOE	92 3 28 1 2 54	197 1 51 50	-45.8 -74.1	-162.1 -22.9	-49.2 -107.9		
ATLAS	ATMOS/GRILLE	92 3 28 2 29 28	3 13 15 48	-38.5 -107.7	124.9 -16.2	-39.3 -128.6	1969	1 26
UARS	HALOE	92 3 28 1 2 54	197 1 51 50	-45.8 -74.1	-162.1 -22.9	-49.2 -107.9		
ATLAS	ATMOS/GRILLE	92 3 28 2 29 28	3 13 15 48	-38.5 -107.7	124.9 -16.2	-39.3 -128.6	1111	0 9
UARS	HALOE	92 3 28 2 39 10	197 3 28 6	-45.7 -98.3	-161.8 -22.9	-49.0 -132.0		
ATLAS	ATMOS/GRILLE	92 3 28 3 59 59	3 14 46 19	-38.9 -130.3	125.0 -16.2	-39.6 -151.3	1846	1 20
UARS	HALOE	92 3 28 2 39 10	197 3 28 6	-45.7 -98.3	-161.8 -22.9	-49.0 -132.0		
ATLAS	ATMOS/GRILLE	92 3 28 3 59 59	3 14 46 19	-38.9 -130.3	125.0 -16.2	-39.6 -151.3	1092	0 15
UARS	HALOE	92 3 28 4 15 26	197 5 4 21	-45.6 -122.4	-161.5 -22.9	-48.8 -156.1		
ATLAS	ATMOS/GRILLE	92 3 28 5 30 29	3 16 16 49	-39.2 -152.9	125.2 -16.2	-40.0 -174.0	1724	1 15
UARS	HALOE	92 3 28 4 15 26	197 5 4 21	-45.6 -122.4	-161.5 -22.9	-48.8 -156.1		
ATLAS	ATMOS/GRILLE	92 3 28 5 30 29	3 16 16 49	-39.2 -152.9	125.2 -16.2	-40.0 -174.0	1087	0 21
UARS	HALOE	92 3 28 5 51 42	197 6 40 38	-45.4 -146.6	-161.2 -22.9	-48.7 179.8		
ATLAS	ATMOS/GRILLE	92 3 28 7 0 59	3 17 47 19	-39.5 -175.5	125.3 -16.2	-40.3 163.4	1602	1 9
UARS	HALOE	92 3 28 5 51 42	197 6 40 38	-45.4 -146.6	-161.2 -22.9	-48.7 179.8		
ATLAS	ATMOS/GRILLE	92 3 28 7 0 59	3 17 47 19	-39.5 -175.5	125.3 -16.2	-40.3 163.4	1096	0 26
UARS	HALOE	92 3 28 7 27 58	197 8 16 54	-45.3 -170.8	-160.9 -22.9	-48.5 155.8		
ATLAS	ATMOS/GRILLE	92 3 28 8 31 29	3 19 17 49	-39.8 161.9	125.5 -16.2	-40.6 140.7	1480	1 3
UARS	HALOE	92 3 28 7 27 58	197 8 16 54	-45.3 -170.8	-160.9 -22.9	-48.5 155.8		
ATLAS	ATMOS/GRILLE	92 3 28 8 31 29	3 19 17 49	-39.8 161.9	125.5 -16.2	-40.6 140.7	1119	0 32
UARS	HALOE	92 3 28 9 4 14	197 9 53 10	-45.2 165.1	-160.5 -22.9	-48.3 131.7		
ATLAS	ATMOS/GRILLE	92 3 28 10 1 59	3 20 48 19	-40.1 139.3	125.7 -16.2	-40.9 118.0	1360	0 57
UARS	HALOE	92 3 28 9 4 14	197 9 53 10	-45.2 165.1	-160.5 -22.9	-48.3 131.7		

Table 3. Continued.

sat.	instrument	gmt yr	mo	da	hr	mn	sc	time into mission da	hr	mn	sc	sub satellite lat	lon	viewing angle beta	alpha	observed point lat	lon	miss dist km	time hr	mn
ATLAS	ATMOS/GRILLE	92	3	28	10	1	59	3	20	48	19	-40.1	139.3	125.7	-16.2	-40.9	118.0	1154	0	38
UARS	HALOE	92	3	28	10	40	29	197	11	29	26	-45.1	140.9	-160.2	-22.9	-48.1	107.6			
ATLAS	ATMOS/GRILLE	92	3	28	11	32	29	3	22	18	49	-40.4	116.7	125.8	-16.2	-41.2	95.3	1240	0	51
UARS	HALOE	92	3	28	10	40	29	197	11	29	26	-45.1	140.9	-160.2	-22.9	-48.1	107.6			
ATLAS	ATMOS/GRILLE	92	3	28	11	32	29	3	22	18	49	-40.4	116.7	125.8	-16.2	-41.2	95.3	1201	0	44
UARS	HALOE	92	3	28	12	16	45	197	13	5	41	-44.9	116.7	-159.9	-22.9	-48.0	83.5			
ATLAS	ATMOS/GRILLE	92	3	28	13	2	59	3	23	49	19	-40.7	94.2	126.0	-16.2	-41.5	72.6	1121	0	46
UARS	HALOE	92	3	28	12	16	45	197	13	5	41	-44.9	116.7	-159.9	-22.9	-48.0	83.5			
ATLAS	ATMOS/GRILLE	92	3	28	13	2	59	3	23	49	19	-40.7	94.2	126.0	-16.2	-41.5	72.6	1258	0	50
UARS	HALOE	92	3	28	13	53	1	197	14	41	57	-44.8	92.5	-159.6	-22.9	-47.8	59.4			
ATLAS	ATMOS/GRILLE	92	3	28	14	33	28	4	1	19	48	-41.0	71.6	126.1	-16.2	-41.8	50.0	1003	0	40
UARS	HALOE	92	3	28	13	53	1	197	14	41	57	-44.8	92.5	-159.6	-22.9	-47.8	59.4			
ATLAS	ATMOS/GRILLE	92	3	28	14	33	28	4	1	19	48	-41.0	71.6	126.1	-16.2	-41.8	50.0	1323	0	55
UARS	HALOE	92	3	28	15	29	17	197	16	18	13	-44.6	68.4	-159.3	-22.9	-47.6	35.4			
ATLAS	ATMOS/GRILLE	92	3	28	16	3	58	4	2	50	18	-41.2	49.0	126.3	-16.2	-42.1	27.3	888	0	34
UARS	HALOE	92	3	28	15	29	17	197	16	18	13	-44.6	68.4	-159.3	-22.9	-47.6	35.4			
ATLAS	ATMOS/GRILLE	92	3	28	16	3	58	4	2	50	18	-41.2	49.0	126.3	-16.2	-42.1	27.3	1396	1	1
UARS	HALOE	92	3	28	17	5	33	197	17	54	30	-44.5	44.2	-159.0	-22.9	-47.5	11.3			
ATLAS	ATMOS/GRILLE	92	3	28	17	34	28	4	4	20	48	-41.5	26.4	126.5	-16.2	-42.3	4.6	774	0	28
UARS	HALOE	92	3	28	17	5	33	197	17	54	30	-44.5	44.2	-159.0	-22.9	-47.5	11.3			
ATLAS	ATMOS/GRILLE	92	3	28	17	34	28	4	4	20	48	-41.5	26.4	126.5	-16.2	-42.3	4.6	1475	1	7
UARS	HALOE	92	3	28	18	41	49	197	19	30	46	-44.4	20.0	-158.7	-22.9	-47.3	-12.8			
ATLAS	ATMOS/GRILLE	92	3	28	19	4	58	4	5	51	18	-41.8	3.8	126.6	-16.2	-42.6	-18.1	663	0	23
UARS	HALOE	92	3	28	18	41	49	197	19	30	46	-44.4	20.0	-158.7	-22.9	-47.3	-12.8			
ATLAS	ATMOS/GRILLE	92	3	28	19	4	58	4	5	51	18	-41.8	3.8	126.6	-16.2	-42.6	-18.1	1560	1	13
UARS	HALOE	92	3	28	20	18	5	197	21	7	1	-44.2	-4.1	-158.3	-22.9	-47.1	-36.9			
ATLAS	ATMOS/GRILLE	92	3	28	20	35	27	4	7	21	47	-42.1	-18.8	126.8	-16.2	-42.9	-40.8	557	0	17
UARS	HALOE	92	3	28	20	18	5	197	21	7	1	-44.2	-4.1	-158.3	-22.9	-47.1	-36.9			
ATLAS	ATMOS/GRILLE	92	3	28	20	35	27	4	7	21	47	-42.1	-18.8	126.8	-16.2	-42.9	-40.8	1648	1	18
UARS	HALOE	92	3	28	21	54	21	197	22	43	17	-44.1	-28.3	-158.0	-22.9	-46.9	-60.9			
ATLAS	ATMOS/GRILLE	92	3	28	22	5	57	4	8	52	17	-42.3	-41.3	127.0	-16.2	-43.2	-63.4	459	0	11
UARS	HALOE	92	3	28	21	54	21	197	22	43	17	-44.1	-28.3	-158.0	-22.9	-46.9	-60.9			

Table 3. Continued.

sat.	instrument	gmt yr mo da hr mn sc	time into mission da hr mn sc	sub satellite lat lon	viewing angle beta alpha	observed point lat lon	miss dist km	miss time hr mn
ATLAS	ATMOS/GRILLE	92 3 28 22 5 57	4 8 52 17	-42.3 -41.3	127.0 -16.2	-43.2 -63.4	1740	1 24
UARS	HALOE	92 3 28 23 30 38	198 0 19 34	-43.9 -52.5	-157.7 -22.9	-46.7 -85.0		
ATLAS	ATMOS/GRILLE	92 3 28 23 36 26	4 10 22 46	-42.6 -63.9	127.2 -16.2	-43.4 -86.1	376	0 5
UARS	HALOE	92 3 28 23 30 38	198 0 19 34	-43.9 -52.5	-157.7 -22.9	-46.7 -85.0		
ATLAS	ATMOS/GRILLE	92 3 29 1 6 55	4 11 53 15	-42.9 -86.5	127.3 -16.2	-43.7 -108.8	1886	1 36
UARS	HALOE	92 3 28 23 30 38	198 0 19 34	-43.9 -52.5	-157.7 -22.9	-46.7 -85.0		
ATLAS	ATMOS/GRILLE	92 3 28 23 36 26	4 10 22 46	-42.6 -63.9	127.2 -16.2	-43.4 -86.1	1835	1 30
UARS	HALOE	92 3 29 1 6 54	198 1 55 50	-43.8 -76.6	-157.4 -22.9	-46.6 -109.1		
ATLAS	ATMOS/GRILLE	92 3 29 1 6 55	4 11 53 15	-42.9 -86.5	127.3 -16.2	-43.7 -108.8	317	0 0
UARS	HALOE	92 3 29 1 6 54	198 1 55 50	-43.8 -76.6	-157.4 -22.9	-46.6 -109.1		
ATLAS	ATMOS/GRILLE	92 3 29 2 37 25	4 13 23 45	-43.1 -109.1	127.5 -16.2	-44.0 -131.5	1770	1 30
UARS	HALOE	92 3 29 1 6 54	198 1 55 50	-43.8 -76.6	-157.4 -22.9	-46.6 -109.1		
ATLAS	ATMOS/GRILLE	92 3 29 1 6 55	4 11 53 15	-42.9 -86.5	127.3 -16.2	-43.7 -108.8	1933	1 36
UARS	HALOE	92 3 29 2 43 10	198 3 32 6	-43.6 -100.8	-157.1 -22.9	-46.4 -133.2		
ATLAS	ATMOS/GRILLE	92 3 29 2 37 25	4 13 23 45	-43.1 -109.1	127.5 -16.2	-44.0 -131.5	298	0 5
UARS	HALOE	92 3 29 2 43 10	198 3 32 6	-43.6 -100.8	-157.1 -22.9	-46.4 -133.2		
ATLAS	ATMOS/GRILLE	92 3 29 4 7 54	4 14 54 14	-43.4 -131.7	127.7 -16.2	-44.2 -154.2	1654	1 24
UARS	HALOE	92 3 29 2 43 10	198 3 32 6	-43.6 -100.8	-157.1 -22.9	-46.4 -133.2		
ATLAS	ATMOS/GRILLE	92 3 29 4 7 54	4 14 54 14	-43.4 -131.7	127.7 -16.2	-44.2 -154.2	326	0 11
UARS	HALOE	92 3 29 4 19 26	198 5 8 21	-43.5 -125.0	-156.8 -22.9	-46.2 -157.3		
ATLAS	ATMOS/GRILLE	92 3 29 5 38 23	4 16 24 43	-43.6 -154.3	127.9 -16.2	-44.5 -176.8	1540	1 18
UARS	HALOE	92 3 29 4 19 26	198 5 8 21	-43.5 -125.0	-156.8 -22.9	-46.2 -157.3		
ATLAS	ATMOS/GRILLE	92 3 29 5 38 23	4 16 24 43	-43.6 -154.3	127.9 -16.2	-44.5 -176.8	390	0 17
UARS	HALOE	92 3 29 5 55 42	198 6 44 38	-43.3 -149.1	-156.5 -22.9	-46.0 178.7		
ATLAS	ATMOS/GRILLE	92 3 29 7 8 53	4 17 55 13	-43.9 -176.8	128.1 -16.2	-44.7 160.5	1426	1 13
UARS	HALOE	92 3 29 5 55 42	198 6 44 38	-43.3 -149.1	-156.5 -22.9	-46.0 178.7		
ATLAS	ATMOS/GRILLE	92 3 29 7 8 53	4 17 55 13	-43.9 -176.8	128.1 -16.2	-44.7 160.5	476	0 23
UARS	HALOE	92 3 29 7 31 58	198 8 20 54	-43.2 -173.3	-156.1 -22.9	-45.8 154.6		
ATLAS	ATMOS/GRILLE	92 3 29 8 39 22	4 19 25 42	-44.1 160.6	128.3 -16.2	-45.0 137.8	1313	1 7
UARS	HALOE	92 3 29 7 31 58	198 8 20 54	-43.2 -173.3	-156.1 -22.9	-45.8 154.6		
ATLAS	ATMOS/GRILLE	92 3 29 8 39 22	4 19 25 42	-44.1 160.6	128.3 -16.2	-45.0 137.8	574	0 28
UARS	HALOE	92 3 29 9 8 14	198 9 57 10	-43.0 162.5	-155.8 -22.9	-45.6 130.5		

Table 3. Continued.

sat.	instrument	gmt yr	mo	da	hr	mn	sc	time into mission da	hr	mn	sc	sub satellite lat	lon	viewing angle beta	alpha	observed point lat	lon	miss dist km	time hr	mn
ATLAS	ATMOS/GRILLE	92	3	29	10	9	51	4	20	56	11	-44.3	138.0	128.5	-16.2	-45.2	115.1	1202	1	1
UARS	HALOE	92	3	29	9	8	14	198	9	57	10	-43.0	162.5	-155.8	-22.9	-45.6	130.5			
ATLAS	ATMOS/GRILLE	92	3	29	10	9	51	4	20	56	11	-44.3	138.0	128.5	-16.2	-45.2	115.1	678	0	34
UARS	HALOE	92	3	29	10	44	31	198	11	33	27	-42.9	138.4	-155.5	-22.9	-45.4	106.4			
ATLAS	ATMOS/GRILLE	92	3	29	11	40	20	4	22	26	40	-44.6	115.4	128.7	-16.2	-45.5	92.4	1092	0	55
UARS	HALOE	92	3	29	10	44	31	198	11	33	27	-42.9	138.4	-155.5	-22.9	-45.4	106.4			
ATLAS	ATMOS/GRILLE	92	3	29	11	40	20	4	22	26	40	-44.6	115.4	128.7	-16.2	-45.5	92.4	787	0	40
UARS	HALOE	92	3	29	12	20	47	198	13	9	43	-42.7	114.2	-155.2	-22.9	-45.2	82.4			
ATLAS	ATMOS/GRILLE	92	3	29	13	10	49	4	23	57	9	-44.8	92.8	128.8	-16.2	-45.7	69.8	984	0	50
UARS	HALOE	92	3	29	12	20	47	198	13	9	43	-42.7	114.2	-155.2	-22.9	-45.2	82.4			
ATLAS	ATMOS/GRILLE	92	3	29	13	10	49	4	23	57	9	-44.8	92.8	128.8	-16.2	-45.7	69.8	898	0	46
UARS	HALOE	92	3	29	13	57	3	198	14	46	0	-42.6	90.0	-154.9	-22.9	-45.0	58.3			
ATLAS	ATMOS/GRILLE	92	3	29	14	41	18	5	1	27	38	-45.0	70.2	129.0	-16.2	-45.9	47.1	880	0	44
UARS	HALOE	92	3	29	13	57	3	198	14	46	0	-42.6	90.0	-154.9	-22.9	-45.0	58.3			
ATLAS	ATMOS/GRILLE	92	3	29	14	41	18	5	1	27	38	-45.0	70.2	129.0	-16.2	-45.9	47.1	1011	0	52
UARS	HALOE	92	3	29	15	33	20	198	16	22	15	-42.4	65.9	-154.6	-22.9	-44.9	34.2			
ATLAS	ATMOS/GRILLE	92	3	29	16	11	47	5	2	58	7	-45.3	47.6	129.2	-16.2	-46.2	24.4	779	0	38
UARS	HALOE	92	3	29	15	33	20	198	16	22	15	-42.4	65.9	-154.6	-22.9	-44.9	34.2			
ATLAS	ATMOS/GRILLE	92	3	29	16	11	47	5	2	58	7	-45.3	47.6	129.2	-16.2	-46.2	24.4	1124	0	57
UARS	HALOE	92	3	29	17	9	36	198	17	58	32	-42.2	41.7	-154.3	-22.9	-44.7	10.1			
ATLAS	ATMOS/GRILLE	92	3	29	17	42	15	5	4	28	35	-45.5	25.1	129.4	-16.2	-46.4	1.7	684	0	32
UARS	HALOE	92	3	29	17	9	36	198	17	58	32	-42.2	41.7	-154.3	-22.9	-44.7	10.1			
ATLAS	ATMOS/GRILLE	92	3	29	17	42	15	5	4	28	35	-45.5	25.1	129.4	-16.2	-46.4	1.7	1239	1	3
UARS	HALOE	92	3	29	18	45	52	198	19	34	48	-42.1	17.5	-153.9	-22.9	-44.5	-13.9			
ATLAS	ATMOS/GRILLE	92	3	29	19	12	44	5	5	59	4	-45.7	2.5	129.6	-16.2	-46.6	-21.0	598	0	26
UARS	HALOE	92	3	29	18	45	52	198	19	34	48	-42.1	17.5	-153.9	-22.9	-44.5	-13.9			
ATLAS	ATMOS/GRILLE	92	3	29	19	12	44	5	5	59	4	-45.7	2.5	129.6	-16.2	-46.6	-21.0	1353	1	9
UARS	HALOE	92	3	29	20	22	9	198	21	11	5	-41.9	-6.6	-153.6	-22.9	-44.3	-38.0			
ATLAS	ATMOS/GRILLE	92	3	29	20	43	13	5	7	29	33	-45.9	-20.1	129.8	-16.2	-46.8	-43.6	524	0	21
UARS	HALOE	92	3	29	20	22	9	198	21	11	5	-41.9	-6.6	-153.6	-22.9	-44.3	-38.0			
ATLAS	ATMOS/GRILLE	92	3	29	20	43	13	5	7	29	33	-45.9	-20.1	129.8	-16.2	-46.8	-43.6	1468	1	15
UARS	HALOE	92	3	29	21	58	25	198	22	47	21	-41.8	-30.8	-153.3	-22.9	-44.1	-62.1			

Table 3. Continued.

sat.	instrument	gmt yr mo da hr mn sc	time into mission da hr mn sc	sub satellite lat lon	viewing angle beta alpha	observed point lat lon	miss dist km	miss time hr mn
ATLAS	ATMOS/GRILLE	92 3 29 22 13 42	5 9 0 2	-46.1 -42.7	130.1 -16.2	-47.0 -66.3	468	0 15
UARS	HALOE	92 3 29 21 58 25	198 22 47 21	-41.8 -30.8	-153.3 -22.9	-44.1 -62.1		
ATLAS	ATMOS/GRILLE	92 3 29 22 13 42	5 9 0 2	-46.1 -42.7	130.1 -16.2	-47.0 -66.3	1583	1 20
UARS	HALOE	92 3 29 23 34 42	199 0 23 38	-41.6 -54.9	-153.0 -22.9	-43.8 -86.2		
ATLAS	ATMOS/GRILLE	92 3 29 23 44 10	5 10 30 30	-46.3 -65.3	130.3 -16.2	-47.2 -89.0	437	0 9
UARS	HALOE	92 3 29 23 34 42	199 0 23 38	-41.6 -54.9	-153.0 -22.9	-43.8 -86.2		
ATLAS	ATMOS/GRILLE	92 3 29 23 44 10	5 10 30 30	-46.3 -65.3	130.3 -16.2	-47.2 -89.0	1698	1 26
UARS	HALOE	92 3 30 1 10 58	199 1 59 54	-41.4 -79.1	-152.7 -22.9	-43.6 -110.2		
ATLAS	ATMOS/GRILLE	92 3 30 1 14 39	5 12 0 59	-46.5 -87.9	130.5 -16.2	-47.4 -111.7	438	0 3
UARS	HALOE	92 3 30 1 10 58	199 1 59 54	-41.4 -79.1	-152.7 -22.9	-43.6 -110.2		
ATLAS	ATMOS/GRILLE	92 3 30 2 45 8	5 13 31 28	-46.7 -110.5	130.7 -16.2	-47.6 -134.4	1922	1 34
UARS	HALOE	92 3 30 1 10 58	199 1 59 54	-41.4 -79.1	-152.7 -22.9	-43.6 -110.2		
ATLAS	ATMOS/GRILLE	92 3 30 1 14 39	5 12 0 59	-46.5 -87.9	130.5 -16.2	-47.4 -111.7	1813	1 32
UARS	HALOE	92 3 30 2 47 15	199 3 36 11	-41.3 -103.3	-152.4 -22.9	-43.4 -134.3		
ATLAS	ATMOS/GRILLE	92 3 30 2 45 8	5 13 31 28	-46.7 -110.5	130.7 -16.2	-47.6 -134.4	468	0 2
UARS	HALOE	92 3 30 2 47 15	199 3 36 11	-41.3 -103.3	-152.4 -22.9	-43.4 -134.3		
ATLAS	ATMOS/GRILLE	92 3 30 4 15 36	5 15 1 56	-46.9 -133.1	130.9 -16.2	-47.8 -157.1	1830	1 28
UARS	HALOE	92 3 30 2 47 15	199 3 36 11	-41.3 -103.3	-152.4 -22.9	-43.4 -134.3		
ATLAS	ATMOS/GRILLE	92 3 30 2 45 8	5 13 31 28	-46.7 -110.5	130.7 -16.2	-47.6 -134.4	1929	1 38
UARS	HALOE	92 3 30 4 23 31	199 5 12 27	-41.1 -127.4	-152.0 -22.9	-43.2 -158.4		
ATLAS	ATMOS/GRILLE	92 3 30 4 15 36	5 15 1 56	-46.9 -133.1	130.9 -16.2	-47.8 -157.1	524	0 7
UARS	HALOE	92 3 30 4 23 31	199 5 12 27	-41.1 -127.4	-152.0 -22.9	-43.2 -158.4		
ATLAS	ATMOS/GRILLE	92 3 30 5 46 4	5 16 32 24	-47.1 -155.6	131.1 -16.2	-48.0 -179.7	1740	1 22
UARS	HALOE	92 3 30 4 23 31	199 5 12 27	-41.1 -127.4	-152.0 -22.9	-43.2 -158.4		
ATLAS	ATMOS/GRILLE	92 3 30 5 46 4	5 16 32 24	-47.1 -155.6	131.1 -16.2	-48.0 -179.7	597	0 13
UARS	HALOE	92 3 30 5 59 48	199 6 48 44	-40.9 -151.6	-151.7 -22.9	-43.0 177.6		
ATLAS	ATMOS/GRILLE	92 3 30 7 14 55	5 18 1 15	-47.2 -178.0	131.4 -16.1	-48.1 158.0	1620	1 15
UARS	HALOE	92 3 30 5 59 48	199 6 48 44	-40.9 -151.6	-151.7 -22.9	-43.0 177.6		
ATLAS	ATMOS/GRILLE	92 3 30 7 14 55	5 18 1 15	-47.2 -178.0	131.4 -16.1	-48.1 158.0	688	0 21
UARS	HALOE	92 3 30 7 36 4	199 8 25 1	-40.7 -175.8	-151.4 -22.9	-42.8 153.5		
ATLAS	ATMOS/GRILLE	92 3 30 8 45 19	5 19 31 39	-47.4 159.4	131.6 -16.1	-48.3 135.4	1536	1 9
UARS	HALOE	92 3 30 7 36 4	199 8 25 1	-40.7 -175.8	-151.4 -22.9	-42.8 153.5		

Table 3. Continued.

sat.	instrument	gmt yr	mo	da	hr	mn	sc	time into mission da	hr	mn	sc	sub satellite lat	lon	viewing angle beta	alpha	observed point lat	lon	miss dist km	time hr	mn
ATLAS	ATMOS/GRILLE	92	3	30	8	45	19	5	19	31	39	-47.4	159.4	131.6	-16.1	-48.3	135.4	787	0	27
UARS	HALOE	92	3	30	9	12	21	199	10	1	16	-40.6	160.1	-151.1	-22.9	-42.6	129.4			
ATLAS	ATMOS/GRILLE	92	3	30	10	15	44	5	21	2	4	-47.6	136.8	131.8	-16.1	-48.5	112.7	1456	1	3
UARS	HALOE	92	3	30	9	12	21	199	10	1	16	-40.6	160.1	-151.1	-22.9	-42.6	129.4			
ATLAS	ATMOS/GRILLE	92	3	30	10	15	44	5	21	2	4	-47.6	136.8	131.8	-16.1	-48.5	112.7	890	0	32
UARS	HALOE	92	3	30	10	48	37	199	11	37	33	-40.4	135.9	-150.8	-22.9	-42.4	105.3			
ATLAS	ATMOS/GRILLE	92	3	30	11	46	8	5	22	32	28	-47.8	114.3	132.0	-16.1	-48.7	90.0	1382	0	57
UARS	HALOE	92	3	30	10	48	37	199	11	37	33	-40.4	135.9	-150.8	-22.9	-42.4	105.3			
ATLAS	ATMOS/GRILLE	92	3	30	11	46	8	5	22	32	28	-47.8	114.3	132.0	-16.1	-48.7	90.0	996	0	38
UARS	HALOE	92	3	30	12	24	54	199	13	13	51	-40.2	111.8	-150.5	-22.9	-42.2	81.3			
ATLAS	ATMOS/GRILLE	92	3	30	13	16	32	6	0	2	52	-48.0	91.7	132.2	-16.1	-48.9	67.4	1314	0	51
UARS	HALOE	92	3	30	12	24	54	199	13	13	51	-40.2	111.8	-150.5	-22.9	-42.2	81.3			
ATLAS	ATMOS/GRILLE	92	3	30	13	16	32	6	0	2	52	-48.0	91.7	132.2	-16.1	-48.9	67.4	1104	0	44
UARS	HALOE	92	3	30	14	1	11	199	14	50	6	-40.0	87.6	-150.2	-22.9	-41.9	57.2			
ATLAS	ATMOS/GRILLE	92	3	30	14	46	57	6	1	33	17	-48.2	69.1	132.5	-16.1	-49.1	44.7	1253	0	45
UARS	HALOE	92	3	30	14	1	11	199	14	50	6	-40.0	87.6	-150.2	-22.9	-41.9	57.2			
ATLAS	ATMOS/GRILLE	92	3	30	14	46	57	6	1	33	17	-48.2	69.1	132.5	-16.1	-49.1	44.7	1215	0	50
UARS	HALOE	92	3	30	15	37	28	199	16	26	23	-39.8	63.4	-149.8	-22.9	-41.7	33.1			
ATLAS	ATMOS/GRILLE	92	3	30	16	17	21	6	3	3	41	-48.3	46.5	132.7	-16.1	-49.2	22.0	1201	0	39
UARS	HALOE	92	3	30	15	37	28	199	16	26	23	-39.8	63.4	-149.8	-22.9	-41.7	33.1			
ATLAS	ATMOS/GRILLE	92	3	30	16	17	21	6	3	3	41	-48.3	46.5	132.7	-16.1	-49.2	22.0	1326	0	56
UARS	HALOE	92	3	30	17	13	44	199	18	2	40	-39.6	39.3	-149.5	-22.9	-41.5	9.1			
ATLAS	ATMOS/GRILLE	92	3	30	17	47	45	6	4	34	5	-48.5	24.0	132.9	-16.1	-49.4	-0.6	1158	0	34
UARS	HALOE	92	3	30	17	13	44	199	18	2	40	-39.6	39.3	-149.5	-22.9	-41.5	9.1			
ATLAS	ATMOS/GRILLE	92	3	30	17	47	45	6	4	34	5	-48.5	24.0	132.9	-16.1	-49.4	-0.6	1439	1	2
UARS	HALOE	92	3	30	18	50	1	199	19	38	57	-39.5	15.1	-149.2	-22.9	-41.3	-15.0			
ATLAS	ATMOS/GRILLE	92	3	30	19	18	9	6	6	4	29	-48.7	1.4	133.1	-16.1	-49.6	-23.3	1126	0	28
UARS	HALOE	92	3	30	18	50	1	199	19	38	57	-39.5	15.1	-149.2	-22.9	-41.3	-15.0			
ATLAS	ATMOS/GRILLE	92	3	30	19	18	9	6	6	4	29	-48.7	1.4	133.1	-16.1	-49.6	-23.3	1552	1	8
UARS	HALOE	92	3	30	20	26	18	199	21	15	14	-39.3	-9.1	-148.9	-22.9	-41.1	-39.1			
ATLAS	ATMOS/GRILLE	92	3	30	20	48	33	6	7	34	53	-48.9	-21.2	133.4	-16.1	-49.7	-46.0	1106	0	22
UARS	HALOE	92	3	30	20	26	18	199	21	15	14	-39.3	-9.1	-148.9	-22.9	-41.1	-39.1			

Table 3. Continued.

sat.	instrument	gmt yr mo da hr mn sc	time into mission da hr mn sc	sub satellite lat lon	viewing angle beta alpha	observed point lat lon	miss dist km	miss time hr mn
ATLAS	ATMOS/GRILLE	92 3 30 20 48 33	6 7 34 53	-48.9 -21.2	133.4 -16.1	-49.7 -46.0	1666	1 14
UARS	HALOE	92 3 30 22 2 35	199 22 51 30	-39.1 -33.2	-148.6 -22.9	-40.8 -63.1		
ATLAS	ATMOS/GRILLE	92 3 30 22 18 57	6 9 5 17	-49.0 -43.8	133.6 -16.1	-49.9 -68.6	1097	0 16
UARS	HALOE	92 3 30 22 2 35	199 22 51 30	-39.1 -33.2	-148.6 -22.9	-40.8 -63.1		
ATLAS	ATMOS/GRILLE	92 3 30 22 18 57	6 9 5 17	-49.0 -43.8	133.6 -16.1	-49.9 -68.6	1780	1 19
UARS	HALOE	92 3 30 23 38 52	200 0 27 47	-38.9 -57.4	-148.3 -22.9	-40.6 -87.2		
ATLAS	ATMOS/GRILLE	92 3 30 23 49 21	6 10 35 41	-49.2 -66.3	133.8 -16.1	-50.1 -91.3	1101	0 10
UARS	HALOE	92 3 30 23 38 52	200 0 27 47	-38.9 -57.4	-148.3 -22.9	-40.6 -87.2		
ATLAS	ATMOS/GRILLE	92 3 30 23 49 21	6 10 35 41	-49.2 -66.3	133.8 -16.1	-50.1 -91.3	1894	1 25
UARS	HALOE	92 3 31 1 15 8	200 2 4 4	-38.7 -81.5	-148.0 -22.9	-40.4 -111.3		
ATLAS	ATMOS/GRILLE	92 3 31 1 19 45	6 12 6 5	-49.4 -88.9	134.1 -16.1	-50.2 -113.9	1118	0 4
UARS	HALOE	92 3 31 1 15 8	200 2 4 4	-38.7 -81.5	-148.0 -22.9	-40.4 -111.3		
ATLAS	ATMOS/GRILLE	92 3 31 2 50 9	6 13 36 29	-49.5 -111.5	134.3 -16.1	-50.4 -136.6	1146	0 1
UARS	HALOE	92 3 31 2 51 25	200 3 40 21	-38.5 -105.7	-147.7 -22.9	-40.1 -135.3		
ATLAS	ATMOS/GRILLE	92 3 31 4 20 33	6 15 6 53	-49.7 -134.1	134.5 -16.1	-50.5 -159.3	1185	0 7
UARS	HALOE	92 3 31 4 27 42	200 5 16 38	-38.3 -129.8	-147.3 -22.9	-39.9 -159.4		
ATLAS	ATMOS/GRILLE	92 3 31 5 50 57	6 16 37 17	-49.8 -156.7	134.8 -16.1	-50.7 178.1	1235	0 13
UARS	HALOE	92 3 31 6 3 59	200 6 52 55	-38.1 -154.0	-147.0 -22.9	-39.7 176.5		
ATLAS	ATMOS/GRILLE	92 3 31 7 21 21	6 18 7 41	-50.0 -179.2	135.0 -16.1	-50.8 155.4	1293	0 18
UARS	HALOE	92 3 31 7 40 16	200 8 29 12	-37.9 -178.2	-146.7 -22.9	-39.4 152.5		
ATLAS	ATMOS/GRILLE	92 3 31 8 51 44	6 19 38 4	-50.1 158.2	135.3 -16.1	-51.0 132.7	1358	0 24
UARS	HALOE	92 3 31 9 16 34	200 10 5 30	-37.7 157.7	-146.4 -22.9	-39.2 128.4		
ATLAS	ATMOS/GRILLE	92 3 31 10 22 8	6 21 8 28	-50.3 135.6	135.5 -16.1	-51.1 110.1	1948	1 5
UARS	HALOE	92 3 31 9 16 34	200 10 5 30	-37.7 157.7	-146.4 -22.9	-39.2 128.4		
ATLAS	ATMOS/GRILLE	92 3 31 10 22 8	6 21 8 28	-50.3 135.6	135.5 -16.1	-51.1 110.1	1431	0 30
UARS	HALOE	92 3 31 10 52 51	200 11 41 47	-37.5 133.5	-146.1 -22.9	-38.9 104.3		
ATLAS	ATMOS/GRILLE	92 3 31 11 52 32	6 22 38 52	-50.4 113.0	135.7 -16.1	-51.3 87.4	1902	0 59
UARS	HALOE	92 3 31 10 52 51	200 11 41 47	-37.5 133.5	-146.1 -22.9	-38.9 104.3		
ATLAS	ATMOS/GRILLE	92 3 31 11 52 32	6 22 38 52	-50.4 113.0	135.7 -16.1	-51.3 87.4	1509	0 36
UARS	HALOE	92 3 31 12 29 8	200 13 18 4	-37.3 109.4	-145.8 -22.9	-38.7 80.3		
ATLAS	ATMOS/GRILLE	92 3 31 13 22 56	7 0 9 16	-50.6 90.4	136.0 -16.1	-51.4 64.8	1861	0 53
UARS	HALOE	92 3 31 12 29 8	200 13 18 4	-37.3 109.4	-145.8 -22.9	-38.7 80.3		

Table 3. Continued.

sat.	instrument	gmt yr	mo	da	hr	mn	sc	time into mission da	hr	mn	sc	sub satellite lat	lon	viewing angle beta	alpha	observed point lat	lon	miss dist km	time hr	mn
ATLAS	ATMOS/GRILLE	92	3	31	13	22	56	7	0	9	16	-50.6	90.4	136.0	-16.1	-51.4	64.8	1593	0	42
UARS	HALOE	92	3	31	14	5	25	200	14	54	21	-37.0	85.2	-145.5	-22.9	-38.4	56.2			
ATLAS	ATMOS/GRILLE	92	3	31	14	53	19	7	1	39	39	-50.7	67.9	136.2	-16.1	-51.6	42.1	1826	0	47
UARS	HALOE	92	3	31	14	5	25	200	14	54	21	-37.0	85.2	-145.5	-22.9	-38.4	56.2			
ATLAS	ATMOS/GRILLE	92	3	31	14	53	19	7	1	39	39	-50.7	67.9	136.2	-16.1	-51.6	42.1	1680	0	48
UARS	HALOE	92	3	31	15	41	42	200	16	30	38	-36.8	61.1	-145.1	-22.9	-38.2	32.1			
ATLAS	ATMOS/GRILLE	92	3	31	16	23	43	7	3	10	3	-50.8	45.3	136.5	-16.1	-51.7	19.4	1799	0	42
UARS	HALOE	92	3	31	15	41	42	200	16	30	38	-36.8	61.1	-145.1	-22.9	-38.2	32.1			
ATLAS	ATMOS/GRILLE	92	3	31	16	23	43	7	3	10	3	-50.8	45.3	136.5	-16.1	-51.7	19.4	1771	0	54
UARS	HALOE	92	3	31	17	18	0	200	18	6	56	-36.6	36.9	-144.8	-22.9	-37.9	8.1			
ATLAS	ATMOS/GRILLE	92	3	31	17	54	6	7	4	40	26	-51.0	22.7	136.7	-16.1	-51.8	-3.2	1779	0	36
UARS	HALOE	92	3	31	17	18	0	200	18	6	56	-36.6	36.9	-144.8	-22.9	-37.9	8.1			
ATLAS	ATMOS/GRILLE	92	3	31	17	54	6	7	4	40	26	-51.0	22.7	136.7	-16.1	-51.8	-3.2	1865	1	0
UARS	HALOE	92	3	31	18	54	17	200	19	43	13	-36.4	12.7	-144.5	-22.9	-37.7	-16.0			
ATLAS	ATMOS/GRILLE	92	3	31	19	24	30	7	6	10	50	-51.1	0.1	137.0	-16.1	-52.0	-25.9	1766	0	30
UARS	HALOE	92	3	31	18	54	17	200	19	43	13	-36.4	12.7	-144.5	-22.9	-37.7	-16.0			
ATLAS	ATMOS/GRILLE	92	3	31	19	24	30	7	6	10	50	-51.1	0.1	137.0	-16.1	-52.0	-25.9	1962	1	6
UARS	HALOE	92	3	31	20	30	34	200	21	19	30	-36.2	-11.4	-144.2	-22.9	-37.4	-40.1			
ATLAS	ATMOS/GRILLE	92	3	31	20	54	53	7	7	41	13	-51.2	-22.5	137.2	-16.1	-52.1	-48.5	1761	0	24
UARS	HALOE	92	3	31	20	30	34	200	21	19	30	-36.2	-11.4	-144.2	-22.9	-37.4	-40.1			
ATLAS	ATMOS/GRILLE	92	3	31	22	25	17	7	9	11	37	-51.4	-45.1	137.5	-16.1	-52.2	-71.2	1763	0	18
UARS	HALOE	92	3	31	22	6	51	200	22	55	47	-36.0	-35.6	-143.9	-22.9	-37.2	-64.1			
ATLAS	ATMOS/GRILLE	92	3	31	23	55	40	7	10	42	0	-51.5	-67.6	137.7	-16.1	-52.3	-93.9	1774	0	12
UARS	HALOE	92	3	31	23	43	9	201	0	32	6	-35.7	-59.7	-143.6	-22.9	-36.9	-88.2			
ATLAS	ATMOS/GRILLE	92	4	1	1	26	4	7	12	12	24	-51.6	-90.2	138.0	-16.1	-52.4	-116.5	1791	0	6
UARS	HALOE	92	4	1	1	19	26	201	2	8	23	-35.5	-83.9	-143.3	-22.9	-36.6	-112.3			
ATLAS	ATMOS/GRILLE	92	4	1	2	56	27	7	13	42	47	-51.7	-112.8	138.2	-16.1	-52.6	-139.2	1817	0	0
UARS	HALOE	92	4	1	2	55	44	201	3	44	40	-35.3	-108.0	-142.9	-22.9	-36.4	-136.3			
ATLAS	ATMOS/GRILLE	92	4	1	4	26	51	7	15	13	11	-51.9	-135.4	138.5	-16.1	-52.7	-161.8	1850	0	5
UARS	HALOE	92	4	1	4	32	1	201	5	20	58	-35.0	-132.2	-142.6	-22.9	-36.1	-160.4			

Table 3. Concluded

sat.	instrument	gmt yr	mo	da	hr	mn	sc	time into mission da	hr	mn	sc	sub satellite lat	lon	viewing angle beta	alpha	observed point lat	lon	miss dist km	time hr	mn
ATLAS	ATMOS/GRILLE	92	4	1	5	57	14	7	16	43	34	-52.0	-158.0	138.7	-16.1	-52.8	175.5	1889	0	11
UARS	HALOE	92	4	1	6	8	19	201	6	57	15	-34.8	-156.3	-142.3	-22.9	-35.8	175.5			
ATLAS	ATMOS/GRILLE	92	4	1	7	27	37	7	18	13	57	-52.1	179.4	139.0	-16.1	-52.9	152.8	1935	0	16
UARS	HALOE	92	4	1	7	44	37	201	8	33	32	-34.6	179.5	-142.0	-22.9	-35.5	151.5			
ATLAS	ATMOS/GRILLE	92	4	1	8	58	1	7	19	44	21	-52.2	156.8	139.3	-16.1	-53.0	130.2	1987	0	22
UARS	HALOE	92	4	1	9	20	54	201	10	9	51	-34.3	155.4	-141.7	-22.9	-35.3	127.4			

Table 4. ATLAS ATMOS/GRILLE coincident with UARS MLS/CLAES/ISAMS.

sat.	instrument	gmt yr	mo	da	hr	mn	sc	time into mission da	hr	mn	sc	sub satellite lat	lon	viewing angle beta	alpha	observed point lat	lon	miss dist km	time hr	mn	solar zenith angle
ATLAS	ATMOS/GRILLE	92	3	27	14	56	50	3	1	43	10	-8.8	211.2	56.1	-16.2	-8.3	227.5	426	3	6	
UARS	MLS/CLAES	92	3	27	18	3	38	196	18	52	34	6.4	250.0	90.0	-22.9	-6.2	230.8				20.8
ATLAS	ATMOS/GRILLE	92	3	27	16	27	23	3	3	13	43	-8.3	188.5	56.0	-16.2	-7.8	204.9	233	3	12	
UARS	MLS/CLAES	92	3	27	19	40	9	196	20	29	5	5.5	226.1	90.0	-22.9	-7.1	206.9				20.3
ATLAS	ATMOS/GRILLE	92	3	27	17	57	56	3	4	44	16	-7.8	165.9	55.9	-16.2	-7.2	182.2	36	3	18	
UARS	MLS/CLAES	92	3	27	21	16	23	196	22	5	19	5.4	201.8	90.0	-22.9	-7.2	182.5				20.6
ATLAS	ATMOS/GRILLE	92	3	27	19	28	29	3	6	14	49	-7.3	143.2	55.7	-16.2	-6.7	159.5	161	3	24	
UARS	MLS/CLAES	92	3	27	22	52	38	196	23	41	33	5.3	177.5	90.0	-22.9	-7.3	158.2				20.8
ATLAS	ATMOS/GRILLE	92	3	28	9	3	24	3	19	49	44	-2.7	299.3	54.4	-16.2	-1.9	315.5	413	2	36	
UARS	MLS/CLAES	92	3	28	11	39	37	197	12	28	33	13.7	337.4	90.0	-22.9	0.4	318.5				30.5
ATLAS	ATMOS/GRILLE	92	3	28	10	33	56	3	21	20	16	-2.2	276.7	54.3	-16.2	-1.3	292.9	221	2	42	
UARS	MLS/CLAES	92	3	28	13	16	7	197	14	5	4	12.8	313.6	90.0	-22.9	-0.5	294.7				30.0
ATLAS	ATMOS/GRILLE	92	3	28	12	4	29	3	22	50	49	-1.7	254.0	54.1	-16.2	-0.8	270.2	30	2	47	
UARS	MLS/CLAES	92	3	28	14	52	22	197	15	41	18	12.7	289.3	90.0	-22.9	-0.6	270.3				30.2
ATLAS	ATMOS/GRILLE	92	3	28	13	35	1	4	0	21	21	-1.2	231.3	54.0	-16.2	-0.3	247.5	171	2	53	
UARS	MLS/CLAES	92	3	28	16	28	52	197	17	17	48	11.7	265.5	90.0	-22.9	-1.4	246.5				29.6
ATLAS	ATMOS/GRILLE	92	3	28	15	5	34	4	1	51	54	-0.7	208.7	53.8	-16.2	0.2	224.9	359	2	59	
UARS	MLS/CLAES	92	3	28	18	5	7	197	18	54	3	11.6	241.1	90.0	-22.9	-1.5	222.1				29.9
ATLAS	ATMOS/GRILLE	92	3	29	3	9	52	4	13	56	12	3.2	27.3	52.4	-16.2	4.3	43.5	368	2	5	
UARS	MLS/CLAES	92	3	29	5	15	51	198	6	4	47	20.0	65.1	90.0	-22.9	5.9	46.4				39.9
ATLAS	ATMOS/GRILLE	92	3	29	4	40	24	4	15	26	44	3.7	4.6	52.2	-16.2	4.8	20.8	179	2	11	
UARS	MLS/CLAES	92	3	29	6	52	6	198	7	41	1	19.9	40.8	90.0	-22.9	5.9	22.1				40.1
ATLAS	ATMOS/GRILLE	92	3	29	6	10	56	4	16	57	16	4.1	341.9	52.0	-16.2	5.3	358.2	32	2	17	
UARS	MLS/CLAES	92	3	29	8	28	36	198	9	17	33	19.0	17.0	90.0	-22.9	5.1	358.3				39.5
ATLAS	ATMOS/GRILLE	92	3	29	7	41	28	4	18	27	48	4.6	319.3	51.9	-16.2	5.8	335.5	195	2	23	
UARS	MLS/CLAES	92	3	29	10	4	51	198	10	53	47	18.9	352.7	90.0	-22.9	5.0	333.9				39.6
ATLAS	ATMOS/GRILLE	92	3	29	9	12	0	4	19	58	20	5.1	296.6	51.7	-16.2	6.3	312.8	381	2	29	
UARS	MLS/CLAES	92	3	29	11	41	21	198	12	30	18	18.0	328.9	90.0	-22.9	4.2	310.1				39.0
ATLAS	ATMOS/GRILLE	92	3	29	19	45	42	5	6	32	2	8.2	137.8	50.3	-16.2	9.7	154.1	461	1	29	
UARS	MLS/CLAES	92	3	29	21	15	19	198	22	4	16	27.9	175.5	90.0	-22.9	12.7	157.0				50.8
ATLAS	ATMOS/GRILLE	92	3	29	21	16	14	5	8	2	34	8.7	115.1	50.1	-16.2	10.1	131.4	285	1	35	
UARS	MLS/CLAES	92	3	29	22	51	50	198	23	40	46	27.0	151.8	90.0	-22.9	11.9	133.3				50.1

Table 4. Continued.

sat.	instrument	gmt yr mo da hr mn sc	time into mission da hr mn sc	sub satellite lat lon	viewing angle beta alpha	observed point lat lon	miss dist km	miss time hr mn	solar zenith angle
ATLAS	ATMOS/GRILLE	92 3 29 22 46 45	5 9 33 5	9.1 92.4	49.9 -16.2	10.6 108.8	109	1 41	
UARS	MLS/CLAES	92 3 30 0 28 20	199 1 17 16	26.1 128.1	90.0 -22.9	11.2 109.6			49.4
ATLAS	ATMOS/GRILLE	92 3 30 0 17 16	5 11 3 36	9.6 69.7	49.7 -16.2	11.1 86.1	77	1 47	
UARS	MLS/CLAES	92 3 30 2 4 51	199 2 53 46	25.2 104.4	90.0 -22.9	10.4 85.8			48.8
ATLAS	ATMOS/GRILLE	92 3 30 1 47 48	5 12 34 8	10.0 47.0	49.4 -16.2	11.5 63.4	246	1 53	
UARS	MLS/CLAES	92 3 30 3 41 5	199 4 30 1	25.2 80.1	90.0 -22.9	10.3 61.5			49.0
ATLAS	ATMOS/GRILLE	92 3 30 3 18 19	5 14 4 39	10.4 24.3	49.2 -16.2	12.0 40.7	422	1 59	
UARS	MLS/CLAES	92 3 30 5 17 36	199 6 6 31	24.3 56.4	90.0 -22.9	9.6 37.8			48.3
ATLAS	ATMOS/GRILLE	92 3 30 13 50 6	6 0 36 26	13.5 226.0	47.7 -16.1	15.2 242.5	296	1 1	
UARS	MLS/CLAES/ISAMS	92 3 30 14 51 50	199 15 40 46	33.1 262.8	90.0 -22.9	16.9 244.6			59.2
ATLAS	ATMOS/GRILLE	92 3 30 15 20 33	6 2 6 53	13.9 203.3	47.4 -16.1	15.6 219.8	136	1 7	
UARS	MLS/CLAES/ISAMS	92 3 30 16 28 20	199 17 17 17	32.2 239.2	90.0 -22.9	16.2 221.0			58.6
ATLAS	ATMOS/GRILLE	92 3 30 16 51 0	6 3 37 20	14.3 180.6	47.2 -16.1	16.1 197.2	58	1 13	
UARS	MLS/CLAES/ISAMS	92 3 30 18 4 35	199 18 53 31	32.2 214.9	90.0 -22.9	16.2 196.6			58.7
ATLAS	ATMOS/GRILLE	92 3 30 18 21 26	6 5 7 46	14.7 157.9	47.0 -16.1	16.5 174.5	201	1 19	
UARS	MLS/CLAES/ISAMS	92 3 30 19 41 5	199 20 30 1	31.3 191.3	90.0 -22.9	15.5 173.0			58.0
ATLAS	ATMOS/GRILLE	92 3 30 19 51 53	6 6 38 13	15.0 135.2	46.8 -16.1	16.9 151.9	366	1 25	
UARS	MLS/CLAES/ISAMS	92 3 30 21 17 36	199 22 6 31	30.4 167.6	90.0 -22.9	14.7 149.3			57.4
ATLAS	ATMOS/GRILLE	92 3 31 4 54 32	6 15 40 52	17.3 359.1	45.4 -16.1	19.4 15.9	432	0 20	
UARS	MLS/CLAES/ISAMS	92 3 31 5 15 3	200 6 3 59	40.4 35.5	90.0 -22.9	22.6 18.2			69.8
ATLAS	ATMOS/GRILLE	92 3 31 5 50 57	6 16 37 17	-49.8 203.3	134.8 -16.1	-50.7 178.1	388	3 25	
UARS	MLS/CLAES/ISAMS	92 3 31 9 16 12	200 10 5 7	-38.7 156.5	90.0 -22.9	-52.0 183.2			111.6
ATLAS	ATMOS/GRILLE	92 3 31 6 24 59	6 17 11 19	17.7 336.4	45.1 -16.1	19.8 353.3	288	0 26	
UARS	MLS/CLAES/ISAMS	92 3 31 6 51 34	200 7 40 30	39.6 12.1	90.0 -22.9	22.0 354.6			69.1
ATLAS	ATMOS/GRILLE	92 3 31 7 55 25	6 18 41 45	18.1 313.7	44.9 -16.1	20.2 330.6	144	0 32	
UARS	MLS/CLAES/ISAMS	92 3 31 8 28 20	200 9 17 17	38.1 349.5	90.0 -22.9	20.9 331.8			67.5
ATLAS	ATMOS/GRILLE	92 3 31 9 25 51	6 20 12 11	18.5 291.0	44.6 -16.1	20.6 308.0	44	0 38	
UARS	MLS/CLAES/ISAMS	92 3 31 10 4 51	200 10 53 47	37.3 326.0	90.0 -22.9	20.2 308.2			66.8
ATLAS	ATMOS/GRILLE	92 3 31 10 56 18	6 21 42 38	18.8 268.3	44.4 -16.1	21.0 285.3	169	0 45	
UARS	MLS/CLAES/ISAMS	92 3 31 11 41 21	200 12 30 18	36.4 302.5	90.0 -22.9	19.6 284.6			66.2
ATLAS	ATMOS/GRILLE	92 3 31 12 26 44	6 23 13 4	19.2 245.6	44.2 -16.1	21.3 262.6	319	0 50	
UARS	MLS/CLAES/ISAMS	92 3 31 13 17 36	200 14 6 32	36.4 278.2	90.0 -22.9	19.5 260.3			66.3

Table 4. Continued.

sat.	instrument	gmt yr	mo	da	hr	mn	sc	time into mission da	hr	mn	sc	sub satellite lat	lon	viewing angle beta	alpha	observed point lat	lon	miss dist km	time hr	mn	solar zenith angle
ATLAS	ATMOS/GRILLE	92	3	31	13	57	10	7	0	43	30	19.5	222.9	43.9	-16.1	21.7	240.0	470	0	56	
UARS	MLS/CLAES/ISAMS	92	3	31	14	54	6	200	15	43	2	35.5	254.6	90.0	-22.9	18.9	236.7				65.6
ATLAS	ATMOS/GRILLE	92	3	31	19	58	54	7	6	45	14	20.9	132.1	42.9	-16.1	23.2	149.4	475	0	20	
UARS	MLS/CLAES/ISAMS	92	3	31	19	38	33	200	20	27	30	46.3	167.4	90.0	-22.9	27.0	151.6				79.3
ATLAS	ATMOS/GRILLE	92	3	31	21	29	20	7	8	15	40	21.3	109.4	42.7	-16.1	23.6	126.7	353	0	14	
UARS	MLS/CLAES/ISAMS	92	3	31	21	15	3	200	22	4	0	45.6	144.2	90.0	-22.9	26.5	128.2				78.6
ATLAS	ATMOS/GRILLE	92	3	31	22	59	46	7	9	46	6	21.6	86.7	42.4	-16.1	24.0	104.0	225	0	7	
UARS	MLS/CLAES/ISAMS	92	3	31	22	51	50	200	23	40	46	44.2	122.0	90.0	-22.9	25.5	105.5				77.0
ATLAS	ATMOS/GRILLE	92	4	1	0	30	12	7	11	16	31	21.9	64.0	42.2	-16.1	24.3	81.4	94	0	1	
UARS	MLS/CLAES/ISAMS	92	4	1	0	28	21	201	1	17	16	43.5	98.7	90.0	-22.9	25.0	82.0				76.3
ATLAS	ATMOS/GRILLE	92	4	1	1	26	4	7	12	12	24	-51.6	269.8	138.0	-16.1	-52.4	243.5	420	3	3	
UARS	MLS/CLAES/ISAMS	92	4	1	4	30	1	201	5	18	57	-40.6	221.7	90.0	-22.9	-54.2	249.1				106.6
ATLAS	ATMOS/GRILLE	92	4	1	2	0	37	7	12	46	57	22.3	41.3	41.9	-16.1	24.7	58.7	38	0	4	
UARS	MLS/CLAES/ISAMS	92	4	1	2	4	51	201	2	53	46	42.7	75.4	90.0	-22.9	24.4	58.5				75.6
ATLAS	ATMOS/GRILLE	92	4	1	2	56	27	7	13	42	47	-51.7	247.2	138.2	-16.1	-52.6	220.8	313	3	9	
UARS	MLS/CLAES/ISAMS	92	4	1	6	6	15	201	6	55	11	-40.5	197.4	90.0	-22.9	-54.1	224.8				106.5
ATLAS	ATMOS/GRILLE	92	4	1	3	31	3	7	14	17	23	22.6	18.6	41.7	-16.1	25.0	36.1	172	0	10	
UARS	MLS/CLAES/ISAMS	92	4	1	3	41	21	201	4	30	18	42.0	52.0	90.0	-22.9	23.8	35.0				74.9
ATLAS	ATMOS/GRILLE	92	4	1	4	26	51	7	15	13	11	-51.9	224.6	138.5	-16.1	-52.7	198.2	200	3	15	
UARS	MLS/CLAES/ISAMS	92	4	1	7	42	46	201	8	31	41	-39.7	174.0	90.0	-22.9	-53.2	201.0				107.2
ATLAS	ATMOS/GRILLE	92	4	1	5	1	29	7	15	47	49	22.9	355.9	41.4	-16.1	25.4	13.4	308	0	16	
UARS	MLS/CLAES/ISAMS	92	4	1	5	17	52	201	6	6	48	41.2	28.7	90.0	-22.9	23.3	11.5				74.2
ATLAS	ATMOS/GRILLE	92	4	1	5	57	14	7	16	43	34	-52.0	202.0	138.7	-16.1	-52.8	175.5	87	3	21	
UARS	MLS/CLAES/ISAMS	92	4	1	9	19	0	201	10	7	56	-39.6	149.7	90.0	-22.9	-53.1	176.7				107.0
ATLAS	ATMOS/GRILLE	92	4	1	6	31	54	7	17	18	14	23.3	333.2	41.2	-16.1	25.8	350.7	446	0	22	
UARS	MLS/CLAES/ISAMS	92	4	1	6	54	22	201	7	43	18	40.4	5.3	90.0	-22.9	22.7	347.9				73.6
ATLAS	ATMOS/GRILLE	92	4	1	7	27	37	7	18	13	57	-52.1	179.4	139.0	-16.1	-52.9	152.8	30	3	27	
UARS	MLS/CLAES/ISAMS	92	4	1	10	55	15	201	11	44	10	-39.5	125.4	90.0	-22.9	-53.0	152.4				106.9
ATLAS	ATMOS/GRILLE	92	4	1	11	3	11	7	21	49	31	24.2	265.1	40.4	-16.1	26.8	282.8	428	1	1	
UARS	MLS/CLAES/ISAMS	92	4	1	10	2	3	201	10	50	59	51.3	297.3	90.0	-22.9	30.4	284.2				88.5
ATLAS	ATMOS/GRILLE	92	4	1	12	33	36	7	23	19	56	24.5	242.4	40.1	-16.1	27.1	260.1	328	0	54	
UARS	MLS/CLAES/ISAMS	92	4	1	11	38	49	201	12	27	45	50.2	275.6	90.0	-22.9	29.7	261.8				86.9

Table 4. Continued.

sat.	instrument	gmt yr	mo	da	hr	mn	sc	time into mission da	hr	mn	sc	sub satellite lat	lon	viewing angle beta	alpha	observed point lat	lon	miss dist km	time hr	mn	solar zenith angle
ATLAS	ATMOS/GRILLE	92	4	1	14	4	2	8	0	50	22	24.8	219.7	39.9	-16.1	27.5	237.5	222	0	48	
UARS	MLS/CLAES/ISAMS	92	4	1	13	15	20	201	14	4	16	49.6	252.6	90.0	-22.9	29.3	238.4				86.2
ATLAS	ATMOS/GRILLE	92	4	1	15	34	27	8	2	20	47	25.1	197.0	39.6	-16.1	27.8	214.8	120	0	42	
UARS	MLS/CLAES/ISAMS	92	4	1	14	51	50	201	15	40	46	49.0	229.6	90.0	-22.9	28.9	215.0				85.5
ATLAS	ATMOS/GRILLE	92	4	1	17	4	52	8	3	51	12	25.5	174.3	39.3	-16.1	28.1	192.1	35	0	36	
UARS	MLS/CLAES/ISAMS	92	4	1	16	28	37	201	17	17	32	47.8	207.7	90.0	-22.9	28.0	192.5				84.0
ATLAS	ATMOS/GRILLE	92	4	1	18	35	18	8	5	21	38	25.8	151.6	39.1	-16.1	28.5	169.5	109	0	30	
UARS	MLS/CLAES/ISAMS	92	4	1	18	5	7	201	18	54	3	47.1	184.6	90.0	-22.9	27.6	169.0				83.3
ATLAS	ATMOS/GRILLE	92	4	1	20	5	43	8	6	52	3	26.1	128.9	38.8	-16.1	28.8	146.8	225	0	24	
UARS	MLS/CLAES/ISAMS	92	4	1	19	41	38	201	20	30	34	46.4	161.4	90.0	-22.9	27.1	145.6				82.6
ATLAS	ATMOS/GRILLE	92	4	1	21	1	6	8	7	47	26	-53.1	336.1	141.4	-16.1	-53.8	308.9	461	2	42	
UARS	MLS/CLAES/ISAMS	92	4	1	23	44	6	202	0	33	2	-41.7	287.7	90.0	-22.9	-55.5	315.5				102.6
ATLAS	ATMOS/GRILLE	92	4	1	21	36	8	8	8	22	28	26.4	106.2	38.6	-16.1	29.1	124.2	344	0	17	
UARS	MLS/CLAES/ISAMS	92	4	1	21	18	8	201	22	7	4	45.7	138.2	90.0	-22.9	26.6	122.2				81.9
ATLAS	ATMOS/GRILLE	92	4	1	22	31	29	8	9	17	49	-53.2	313.5	141.6	-16.1	-53.9	286.3	356	2	48	
UARS	MLS/CLAES/ISAMS	92	4	2	1	20	20	202	2	9	17	-41.6	263.4	90.0	-22.9	-55.4	291.2				102.5
ATLAS	ATMOS/GRILLE	92	4	1	23	6	33	8	9	52	53	26.6	83.5	38.3	-16.1	29.4	101.5	432	1	54	
UARS	MLS/CLAES/ISAMS	92	4	1	21	12	31	201	22	1	27	55.6	110.0	90.0	-22.9	33.2	102.6				98.6
ATLAS	ATMOS/GRILLE	92	4	1	23	6	33	8	9	52	53	26.6	83.5	38.3	-16.1	29.4	101.5	465	0	11	
UARS	MLS/CLAES/ISAMS	92	4	1	22	54	39	201	23	43	35	45.0	115.0	90.0	-22.9	26.1	98.7				81.2
ATLAS	ATMOS/GRILLE	92	4	2	0	1	52	8	10	48	13	-53.3	290.9	141.9	-16.1	-54.0	263.6	253	2	54	
UARS	MLS/CLAES/ISAMS	92	4	2	2	56	35	202	3	45	31	-41.5	239.1	90.0	-22.9	-55.3	266.8				102.4
ATLAS	ATMOS/GRILLE	92	4	2	0	36	58	8	11	23	18	26.9	60.8	38.0	-16.1	29.8	78.8	365	1	47	
UARS	MLS/CLAES/ISAMS	92	4	1	22	49	2	201	23	37	57	55.3	87.4	90.0	-22.9	33.0	79.3				97.9
ATLAS	ATMOS/GRILLE	92	4	2	1	32	16	8	12	18	36	-53.4	268.3	142.1	-16.1	-54.1	240.9	146	3	0	
UARS	MLS/CLAES/ISAMS	92	4	2	4	33	5	202	5	22	1	-40.7	215.7	90.0	-22.9	-54.4	243.1				103.0
ATLAS	ATMOS/GRILLE	92	4	2	2	7	23	8	12	53	43	27.2	38.1	37.7	-16.1	30.1	56.2	331	3	24	
UARS	MLS/CLAES/ISAMS	92	4	1	22	42	53	201	23	31	49	55.3	48.0	90.0	-22.9	33.0	55.6				115.7
ATLAS	ATMOS/GRILLE	92	4	2	2	7	23	8	12	53	43	27.2	38.1	37.7	-16.1	30.1	56.2	292	1	41	
UARS	MLS/CLAES/ISAMS	92	4	2	0	25	48	202	1	14	45	54.6	66.4	90.0	-22.9	32.6	57.1				96.4
ATLAS	ATMOS/GRILLE	92	4	2	3	2	39	8	13	48	59	-53.4	245.7	142.4	-16.1	-54.2	218.3	37	3	6	
UARS	MLS/CLAES/ISAMS	92	4	2	6	9	20	202	6	58	16	-40.6	191.4	90.0	-22.9	-54.3	218.8				102.9

Table 4. Continued.

sat.	instrument	gmt yr	mo	da	hr	mn	sc	time into mission da	hr	mn	sc	sub satellite lat	lon	viewing angle beta	alpha	observed point lat	lon	miss dist km	time hr	mn	solar zenith angle
ATLAS	ATMOS/GRILLE	92	4	2	3	37	48	8	14	24	8	27.5	15.4	37.5	-16.1	30.4	33.5	331	3	18	
UARS	MLS/CLAES/ISAMS	92	4	2	0	19	39	202	1	8	35	55.8	27.1	90.0	-22.9	33.4	33.3				114.2
ATLAS	ATMOS/GRILLE	92	4	2	3	37	48	8	14	24	8	27.5	15.4	37.5	-16.1	30.4	33.5	218	1	35	
UARS	MLS/CLAES/ISAMS	92	4	2	2	2	19	202	2	51	15	54.2	43.7	90.0	-22.9	32.3	33.8				95.7
ATLAS	ATMOS/GRILLE	92	4	2	4	33	2	8	15	19	22	-53.5	223.1	142.7	-16.1	-54.3	195.6	73	3	12	
UARS	MLS/CLAES/ISAMS	92	4	2	7	45	34	202	8	34	30	-40.5	167.2	90.0	-22.9	-54.2	194.5				102.7
ATLAS	ATMOS/GRILLE	92	4	2	5	8	13	8	15	54	33	27.8	352.7	37.2	-16.1	30.7	10.9	322	3	12	
UARS	MLS/CLAES/ISAMS	92	4	2	1	56	10	202	2	45	6	56.1	4.6	90.0	-22.9	33.5	10.1				113.4
ATLAS	ATMOS/GRILLE	92	4	2	5	8	13	8	15	54	33	27.8	352.7	37.2	-16.1	30.7	10.9	137	1	29	
UARS	MLS/CLAES/ISAMS	92	4	2	3	39	5	202	4	28	1	53.4	22.5	90.0	-22.9	31.8	11.5				94.2
ATLAS	ATMOS/GRILLE	92	4	2	6	3	25	8	16	49	45	-53.6	200.5	143.0	-16.1	-54.4	173.0	183	3	18	
UARS	MLS/CLAES/ISAMS	92	4	2	9	21	49	202	10	10	45	-40.5	142.9	90.0	-22.9	-54.1	170.2				102.6
ATLAS	ATMOS/GRILLE	92	4	2	6	38	38	8	17	24	58	28.1	330.0	36.9	-16.1	31.0	348.2	308	3	5	
UARS	MLS/CLAES/ISAMS	92	4	2	3	32	56	202	4	21	52	56.5	343.8	90.0	-22.9	33.8	347.9				111.9
ATLAS	ATMOS/GRILLE	92	4	2	6	38	38	8	17	24	58	28.1	330.0	36.9	-16.1	31.0	348.2	55	1	23	
UARS	MLS/CLAES/ISAMS	92	4	2	5	15	36	202	6	4	31	52.9	359.7	90.0	-22.9	31.5	348.2				93.5
ATLAS	ATMOS/GRILLE	92	4	2	7	33	47	8	18	20	7	-53.7	177.9	143.2	-16.1	-54.4	150.3	290	3	24	
UARS	MLS/CLAES/ISAMS	92	4	2	10	58	19	202	11	47	15	-39.7	119.5	90.0	-22.9	-53.1	146.5				103.2
ATLAS	ATMOS/GRILLE	92	4	2	8	9	3	8	18	55	23	28.4	307.3	36.7	-16.1	31.3	325.5	293	2	59	
UARS	MLS/CLAES/ISAMS	92	4	2	5	9	43	202	5	58	39	56.8	323.1	90.0	-22.9	34.0	325.7				110.4
ATLAS	ATMOS/GRILLE	92	4	2	8	9	3	8	18	55	23	28.4	307.3	36.7	-16.1	31.3	325.5	55	1	16	
UARS	MLS/CLAES/ISAMS	92	4	2	6	52	22	202	7	41	18	51.9	338.3	90.0	-22.9	30.9	325.8				92.0
ATLAS	ATMOS/GRILLE	92	4	2	9	39	28	8	20	25	48	28.6	284.6	36.4	-16.1	31.6	302.9	267	2	53	
UARS	MLS/CLAES/ISAMS	92	4	2	6	46	13	202	7	35	9	56.9	300.7	90.0	-22.9	34.0	302.5				109.7
ATLAS	ATMOS/GRILLE	92	4	2	9	39	28	8	20	25	48	28.6	284.6	36.4	-16.1	31.6	302.9	127	1	10	
UARS	MLS/CLAES/ISAMS	92	4	2	8	28	53	202	9	17	49	51.4	315.4	90.0	-22.9	30.5	302.5				91.3
ATLAS	ATMOS/GRILLE	92	4	2	11	9	53	8	21	56	13	28.9	261.9	36.1	-16.1	31.9	280.2	239	2	46	
UARS	MLS/CLAES/ISAMS	92	4	2	8	23	0	202	9	11	55	57.0	280.0	90.0	-22.9	34.1	280.3				108.2
ATLAS	ATMOS/GRILLE	92	4	2	11	9	53	8	21	56	13	28.9	261.9	36.1	-16.1	31.9	280.2	222	1	4	
UARS	MLS/CLAES/ISAMS	92	4	2	10	5	23	202	10	54	19	50.9	292.5	90.0	-22.9	30.2	279.1				90.6
ATLAS	ATMOS/GRILLE	92	4	2	12	40	17	8	23	26	37	29.2	239.1	35.9	-16.1	32.2	257.6	210	2	40	
UARS	MLS/CLAES/ISAMS	92	4	2	9	59	30	202	10	48	27	57.0	257.6	90.0	-22.9	34.1	257.1				107.5

Table 4. Concluded.

sat.	instrument	gmt yr	mo	da	hr	mn	sc	time into mission da	hr	mn	sc	sub satellite lat	lon	viewing angle beta	alpha	observed point lat	lon	miss dist km	time hr	mn	solar zenith angle
ATLAS	ATMOS/GRILLE	92	4	2	12	40	17	8	23	26	37	29.2	239.1	35.9	-16.1	32.2	257.6	322	0	58	
UARS	MLS/CLAES/ISAMS	92	4	2	11	41	54	202	12	30	49	50.3	269.6	90.0	-22.9	29.8	255.8				89.9
ATLAS	ATMOS/GRILLE	92	4	2	14	10	42	9	0	57	2	29.4	216.4	35.6	-16.1	32.5	234.9	167	2	34	
UARS	MLS/CLAES/ISAMS	92	4	2	11	36	17	202	12	25	13	56.9	237.0	90.0	-22.9	34.0	234.9				106.0

Table 5. ATLAS ATMOS/GRILLE coincident with UARS ISAMS-R.

sat.	instrument	gmt yr	mo	da	hr	mn	sc	time into mission da	hr	mn	sc	sub satellite lat	lon	viewing angle beta	alpha	observed point lat	lon	miss dist km	time hr	mn	solar zenith angle
ATLAS	ATMOS/GRILLE	92	3	27	0	50	46	2	11	37	6	-32.5	276.2	122.9	-16.2	-33.1	256.9	18	0	3	
UARS	ISAMS-R	92	3	27	0	54	24	196	1	43	20	-55.4	264.8	-90.0	-22.9	-33.1	257.1				96.1
ATLAS	ATMOS/GRILLE	92	3	27	2	21	17	2	13	7	37	-32.9	253.6	123.0	-16.2	-33.5	234.3	47	1	32	
UARS	ISAMS-R	92	3	27	0	48	31	196	1	37	26	-55.4	227.0	-90.0	-22.9	-33.1	234.4				74.6
ATLAS	ATMOS/GRILLE	92	3	27	2	21	17	2	13	7	37	-32.9	253.6	123.0	-16.2	-33.5	234.3	79	0	9	
UARS	ISAMS-R	92	3	27	2	30	54	196	3	19	50	-55.1	242.2	-90.0	-22.9	-32.9	233.9				97.0
ATLAS	ATMOS/GRILLE	92	3	27	3	51	48	2	14	38	8	-33.3	231.1	123.1	-16.2	-33.9	211.6	74	1	26	
UARS	ISAMS-R	92	3	27	2	25	18	196	3	14	14	-55.9	206.1	-90.0	-22.9	-33.5	212.2				76.5
ATLAS	ATMOS/GRILLE	92	3	27	3	51	48	2	14	38	8	-33.3	231.1	123.1	-16.2	-33.9	211.6	164	0	15	
UARS	ISAMS-R	92	3	27	4	7	41	196	4	56	37	-54.4	221.1	-90.0	-22.9	-32.5	211.6				98.9
ATLAS	ATMOS/GRILLE	92	3	27	5	22	19	2	16	8	39	-33.7	208.5	123.2	-16.2	-34.3	188.9	79	1	20	
UARS	ISAMS-R	92	3	27	4	1	48	196	4	50	44	-56.2	183.6	-90.0	-22.9	-33.6	188.9				77.5
ATLAS	ATMOS/GRILLE	92	3	27	5	22	19	2	16	8	39	-33.7	208.5	123.2	-16.2	-34.3	188.9	242	0	21	
UARS	ISAMS-R	92	3	27	5	44	11	196	6	33	8	-53.9	198.4	-90.0	-22.9	-32.2	188.3				99.8
ATLAS	ATMOS/GRILLE	92	3	27	6	52	50	2	17	39	10	-34.1	185.9	123.3	-16.2	-34.7	166.2	106	1	14	
UARS	ISAMS-R	92	3	27	5	38	35	196	6	27	30	-56.6	162.8	-90.0	-22.9	-33.8	166.7				79.4
ATLAS	ATMOS/GRILLE	92	3	27	6	52	50	2	17	39	10	-34.1	185.9	123.3	-16.2	-34.7	166.2	330	0	27	
UARS	ISAMS-R	92	3	27	7	20	42	196	8	9	38	-53.5	175.7	-90.0	-22.9	-31.9	165.0				100.7
ATLAS	ATMOS/GRILLE	92	3	27	8	23	21	2	19	9	41	-34.4	163.3	123.4	-16.2	-35.1	143.6	129	1	8	
UARS	ISAMS-R	92	3	27	7	15	5	196	8	4	2	-56.7	140.4	-90.0	-22.9	-33.9	143.5				80.3
ATLAS	ATMOS/GRILLE	92	3	27	8	23	21	2	19	9	41	-34.4	163.3	123.4	-16.2	-35.1	143.6	422	0	33	
UARS	ISAMS-R	92	3	27	8	57	12	196	9	46	8	-53.0	152.9	-90.0	-22.9	-31.6	141.7				101.7
ATLAS	ATMOS/GRILLE	92	3	27	9	53	52	2	20	40	12	-34.8	140.7	123.5	-16.2	-35.5	120.9	163	1	2	
UARS	ISAMS-R	92	3	27	8	51	52	196	9	40	48	-56.9	119.7	-90.0	-22.9	-34.0	121.3				82.2
ATLAS	ATMOS/GRILLE	92	3	27	11	24	23	2	22	10	43	-35.2	118.1	123.6	-16.2	-35.8	98.2	196	0	56	
UARS	ISAMS-R	92	3	27	10	28	22	196	11	17	18	-57.0	97.3	-90.0	-22.9	-34.1	98.1				83.2
ATLAS	ATMOS/GRILLE	92	3	27	12	54	54	2	23	41	14	-35.5	95.5	123.7	-16.2	-36.2	75.5	238	0	49	
UARS	ISAMS-R	92	3	27	12	5	9	196	12	54	4	-57.0	76.6	-90.0	-22.9	-34.1	75.9				85.1
ATLAS	ATMOS/GRILLE	92	3	27	14	25	25	3	1	11	45	-35.9	72.9	123.8	-16.2	-36.6	52.8	279	0	43	
UARS	ISAMS-R	92	3	27	13	41	39	196	14	30	36	-56.9	54.2	-90.0	-22.9	-34.1	52.7				86.0
ATLAS	ATMOS/GRILLE	92	3	27	15	55	55	3	2	42	15	-36.2	50.4	124.0	-16.2	-36.9	30.2	330	0	37	
UARS	ISAMS-R	92	3	27	15	18	10	196	16	7	6	-56.9	31.8	-90.0	-22.9	-34.0	29.5				86.9

Table 5. Concluded.

sat.	instrument	gmt yr	mo	da	hr	mn	sc	time into mission da	hr	mn	sc	sub satellite lat	lon	viewing angle beta	alpha	observed point lat	lon	miss dist km	time hr	mn	solar zenith angle
ATLAS	ATMOS/GRILLE	92	3	27	17	26	26	3	4	12	46	-36.6	27.8	124.1	-16.2	-37.3	7.5	380	0	31	
UARS	ISAMS-R	92	3	27	16	54	56	196	17	43	52	-56.6	11.1	-90.0	-22.9	-33.9	7.3				88.8
ATLAS	ATMOS/GRILLE	92	3	27	18	56	57	3	5	43	16	-36.9	5.2	124.2	-16.2	-37.6	344.8	435	0	25	
UARS	ISAMS-R	92	3	27	18	31	27	196	19	20	22	-56.4	348.7	-90.0	-22.9	-33.8	344.1				89.7
ATLAS	ATMOS/GRILLE	92	3	27	20	27	27	3	7	13	47	-37.2	342.6	124.3	-16.2	-38.0	322.1	496	0	19	
UARS	ISAMS-R	92	3	27	20	7	57	196	20	56	54	-56.2	326.2	-90.0	-22.9	-33.6	320.8				90.7

Table 6. ATLAS MAS coincident with UARS HALOE.

sat.	instrument	gmt yr mo da hr mn sc	time into mission da hr mn sc	sub satellite lat lon	viewing angle beta alpha	observed point lat lon	miss dist km	miss time hr mn	solar zenith angle
UARS	HALOE	92 3 24 14 13 21	193 15 2 17	50.0 198.4	-1.6 -22.9	57.6 235.6	55	2 13	
ATLAS	MAS	92 3 24 16 26 29	0 3 12 49	46.4 253.8	-90.0 -16.2	58.0 234.9			57.3
UARS	HALOE	92 3 24 15 49 36	193 16 38 32	50.1 174.2	-1.9 -22.9	57.7 211.5	52	2 7	
ATLAS	MAS	92 3 24 17 56 41	0 4 43 1	45.9 229.9	-90.0 -16.2	57.3 211.1			57.6
UARS	HALOE	92 3 24 17 25 51	193 18 14 47	50.2 150.0	-2.3 -22.9	57.9 187.3	75	2 1	
ATLAS	MAS	92 3 24 19 27 9	0 6 13 29	46.0 207.0	-90.0 -16.2	57.4 188.3			57.8
UARS	HALOE	92 3 24 19 2 6	193 19 51 2	50.3 125.8	-2.6 -22.9	58.0 163.2	143	1 55	
ATLAS	MAS	92 3 24 20 57 36	0 7 43 56	46.0 184.2	-90.0 -16.2	57.5 165.5			57.9
UARS	HALOE	92 3 24 20 38 21	193 21 27 17	50.4 101.6	-2.9 -22.9	58.1 139.1	208	1 49	
ATLAS	MAS	92 3 24 22 27 48	0 9 14 8	45.5 160.3	-90.0 -16.2	56.8 141.6			58.3
UARS	HALOE	92 3 24 22 14 36	193 23 3 33	50.4 77.4	-3.2 -22.9	58.2 115.0	271	1 43	
ATLAS	MAS	92 3 24 23 58 16	0 10 44 36	45.6 137.5	-90.0 -16.2	56.9 118.8			58.5
UARS	HALOE	92 3 24 23 50 52	194 0 39 47	50.5 53.2	-3.5 -22.9	58.4 90.8	339	1 37	
ATLAS	MAS	92 3 25 1 28 43	0 12 15 3	45.6 114.7	-90.0 -16.2	57.0 96.0			58.6
UARS	HALOE	92 3 25 1 27 7	194 2 16 3	50.6 29.0	-3.8 -22.9	58.5 66.7	404	1 31	
ATLAS	MAS	92 3 25 2 58 56	0 13 45 16	45.1 90.8	-90.0 -16.2	56.3 72.2			59.0
UARS	HALOE	92 3 25 3 3 22	194 3 52 17	50.7 4.8	-4.1 -22.9	58.6 42.6	469	1 26	
ATLAS	MAS	92 3 25 4 29 23	0 15 15 43	45.2 68.0	-90.0 -16.2	56.5 49.4			59.2
UARS	HALOE	92 3 25 6 15 52	194 7 4 47	50.8 316.4	-4.8 -22.9	58.8 354.3	469	2 46	
ATLAS	MAS	92 3 25 9 2 31	0 19 48 51	49.6 7.4	-90.0 -16.2	62.0 348.7			57.6
UARS	HALOE	92 3 25 7 52 7	194 8 41 3	50.9 292.2	-5.1 -22.9	59.0 330.2	409	2 40	
ATLAS	MAS	92 3 25 10 32 43	0 21 19 3	49.1 343.4	-90.0 -16.2	61.4 324.6			58.0
UARS	HALOE	92 3 25 9 28 22	194 10 17 17	51.0 268.0	-5.4 -22.9	59.1 306.1	354	2 34	
ATLAS	MAS	92 3 25 12 3 11	0 22 49 31	49.1 320.6	-90.0 -16.2	61.5 301.8			58.1
UARS	HALOE	92 3 25 11 4 37	194 11 53 33	51.0 243.8	-5.7 -22.9	59.2 282.0	293	2 28	
ATLAS	MAS	92 3 25 13 33 23	1 0 19 43	48.7 296.6	-90.0 -16.2	60.8 277.8			58.5
UARS	HALOE	92 3 25 12 40 52	194 13 29 48	51.1 219.6	-6.0 -22.9	59.3 257.8	237	2 22	
ATLAS	MAS	92 3 25 15 3 51	1 1 50 11	48.7 273.8	-90.0 -16.2	60.9 255.0			58.6
UARS	HALOE	92 3 25 14 17 7	194 15 6 2	51.2 195.4	-6.3 -22.9	59.4 233.7	176	2 16	
ATLAS	MAS	92 3 25 16 34 3	1 3 20 23	48.2 249.8	-90.0 -16.2	60.3 231.0			59.0
UARS	HALOE	92 3 25 15 53 22	194 16 42 18	51.3 171.2	-6.7 -22.9	59.6 209.6	118	2 11	
ATLAS	MAS	92 3 25 18 4 30	1 4 50 50	48.3 227.0	-90.0 -16.2	60.4 208.2			59.2

Table 6. Continued.

sat.	instrument	gmt yr mo da hr mn sc	time into mission da hr mn sc	sub satellite lat lon	viewing angle beta alpha	observed point lat lon	miss dist km	miss time hr mn	solar zenith angle
UARS	HALOE	92 3 25 17 29 37	194 18 18 32	51.3 147.1	-7.0 -22.9	59.7 185.4	66	2 5	
ATLAS	MAS	92 3 25 19 34 43	1 6 21 3	47.8 203.1	-90.0 -16.2	59.7 184.3			59.6
UARS	HALOE	92 3 25 19 5 51	194 19 54 48	51.4 122.9	-7.3 -22.9	59.8 161.3	9	1 59	
ATLAS	MAS	92 3 25 21 5 10	1 7 51 30	47.9 180.2	-90.0 -16.2	59.8 161.5			59.7
UARS	HALOE	92 3 25 20 42 6	194 21 31 2	51.5 98.7	-7.6 -22.9	59.9 137.2	82	1 53	
ATLAS	MAS	92 3 25 22 35 38	1 9 21 58	48.0 157.4	-90.0 -16.2	59.9 138.7			59.8
UARS	HALOE	92 3 25 22 18 21	194 23 7 17	51.5 74.5	-7.9 -22.9	60.0 113.1	125	1 47	
ATLAS	MAS	92 3 26 0 5 50	1 10 52 10	47.4 133.5	-90.0 -16.2	59.3 114.7			60.3
UARS	HALOE	92 3 25 23 54 36	195 0 43 32	51.6 50.3	-8.2 -22.9	60.1 88.9	188	1 41	
ATLAS	MAS	92 3 26 1 36 17	1 12 22 37	47.5 110.7	-90.0 -16.2	59.4 91.9			60.4
UARS	HALOE	92 3 26 1 30 51	195 2 19 47	51.7 26.1	-8.6 -22.9	60.2 64.8	250	1 35	
ATLAS	MAS	92 3 26 3 6 30	1 13 52 50	47.0 86.7	-90.0 -16.2	58.7 68.0			60.9
UARS	HALOE	92 3 26 3 7 6	195 3 56 3	51.7 1.9	-8.9 -22.9	60.4 40.7	308	1 29	
ATLAS	MAS	92 3 26 4 36 57	1 15 23 17	47.1 63.9	-90.0 -16.2	58.8 45.2			61.0
UARS	HALOE	92 3 26 4 43 21	195 5 32 17	51.8 337.7	-9.2 -22.9	60.5 16.5	372	1 24	
ATLAS	MAS	92 3 26 6 7 25	1 16 53 45	47.2 41.1	-90.0 -16.2	58.9 22.4			61.2
UARS	HALOE	92 3 26 6 19 36	195 7 8 31	51.9 313.5	-9.5 -22.9	60.6 352.4	433	1 18	
ATLAS	MAS	92 3 26 7 37 37	1 18 23 57	46.6 17.2	-90.0 -16.2	58.2 358.5			61.7
UARS	HALOE	92 3 26 7 55 51	195 8 44 47	51.9 289.3	-9.8 -22.9	60.7 328.3	476	2 44	
ATLAS	MAS	92 3 26 10 40 17	1 21 26 37	50.7 339.9	-90.0 -16.2	63.6 321.4			59.4
UARS	HALOE	92 3 26 9 32 6	195 10 21 2	52.0 265.1	-10.1 -22.9	60.8 304.1	424	2 38	
ATLAS	MAS	92 3 26 12 10 45	1 22 57 5	50.8 317.1	-90.0 -16.2	63.7 298.7			59.5
UARS	HALOE	92 3 26 11 8 21	195 11 57 16	52.1 240.9	-10.4 -22.9	60.9 280.0	372	2 32	
ATLAS	MAS	92 3 26 13 40 57	2 0 27 17	50.3 293.0	-90.0 -16.2	63.0 274.5			60.0
UARS	HALOE	92 3 26 12 44 35	195 13 33 32	52.1 216.7	-10.8 -22.9	61.0 255.9	318	2 26	
ATLAS	MAS	92 3 26 15 11 25	2 1 57 45	50.4 270.2	-90.0 -16.2	63.1 251.7			60.1
UARS	HALOE	92 3 26 14 20 50	195 15 9 46	52.2 192.5	-11.1 -22.9	61.1 231.7	266	2 20	
ATLAS	MAS	92 3 26 16 41 37	2 3 27 57	49.9 246.2	-90.0 -16.2	62.5 227.6			60.6
UARS	HALOE	92 3 26 15 57 5	195 16 46 1	52.3 168.3	-11.4 -22.9	61.2 207.6	210	2 14	
ATLAS	MAS	92 3 26 18 12 5	2 4 58 25	50.0 223.4	-90.0 -16.2	62.6 204.8			60.7
UARS	HALOE	92 3 26 17 33 20	195 18 22 16	52.3 144.1	-11.7 -22.9	61.4 183.5	161	2 8	
ATLAS	MAS	92 3 26 19 42 17	2 6 28 37	49.5 199.3	-90.0 -16.2	62.0 180.7			61.2

Table 6. Continued.

sat.	instrument	gmt yr	mo	da	hr	mn	sc	time into mission da	hr	mn	sc	sub satellite lat	lon	viewing angle beta	alpha	observed point lat	lon	miss dist km	time hr	mn	solar zenith angle
UARS	HALOE	92	3	26	19	9	35	195	19	58	31	52.4	119.9	-12.0	-22.9	61.5	159.3	100	2	3	
ATLAS	MAS	92	3	26	21	12	44	2	7	59	4	49.6	176.5	-90.0	-16.2	62.1	157.9				61.3
UARS	HALOE	92	3	26	20	45	50	195	21	34	45	52.4	95.7	-12.3	-22.9	61.6	135.2	66	1	57	
ATLAS	MAS	92	3	26	22	43	12	2	9	29	32	49.7	153.7	-90.0	-16.2	62.2	135.1				61.4
UARS	HALOE	92	3	26	22	22	4	195	23	11	1	52.5	71.5	-12.6	-22.9	61.7	111.0	16	1	51	
ATLAS	MAS	92	3	27	0	13	24	2	10	59	44	49.2	129.7	-90.0	-16.2	61.5	111.1				61.9
UARS	HALOE	92	3	26	23	58	19	196	0	47	15	52.6	47.3	-13.0	-22.9	61.8	86.9	74	1	45	
ATLAS	MAS	92	3	27	1	43	52	2	12	30	12	49.3	106.9	-90.0	-16.2	61.6	88.3				62.0
UARS	HALOE	92	3	27	1	34	34	196	2	23	30	52.6	23.1	-13.3	-22.9	61.9	62.8	127	1	39	
ATLAS	MAS	92	3	27	3	14	4	2	14	0	24	48.8	82.9	-90.0	-16.2	61.0	64.3				62.5
UARS	HALOE	92	3	27	3	10	49	196	3	59	45	52.7	358.9	-13.6	-22.9	62.0	38.6	180	1	33	
ATLAS	MAS	92	3	27	4	44	31	2	15	30	51	48.9	60.1	-90.0	-16.2	61.1	41.5				62.7
UARS	HALOE	92	3	27	4	47	4	196	5	36	0	52.7	334.7	-13.9	-22.9	62.1	14.5	242	1	27	
ATLAS	MAS	92	3	27	6	14	59	2	17	1	19	48.9	37.3	-90.0	-16.2	61.2	18.7				62.8
UARS	HALOE	92	3	27	6	23	18	196	7	12	14	52.8	310.6	-14.2	-22.9	62.2	350.4	336	1	19	
ATLAS	MAS	92	3	27	7	43	14	2	18	29	34	48.1	13.4	-90.0	-16.2	60.1	354.8				63.4
UARS	HALOE	92	3	27	7	59	33	196	8	48	29	52.9	286.4	-14.5	-22.9	62.3	326.2	390	1	14	
ATLAS	MAS	92	3	27	9	13	39	2	19	59	59	48.2	350.6	-90.0	-16.2	60.2	332.0				63.5
UARS	HALOE	92	3	27	9	35	47	196	10	24	43	52.9	262.2	-14.8	-22.9	62.4	302.1	449	1	8	
ATLAS	MAS	92	3	27	10	44	5	2	21	30	25	48.3	327.8	-90.0	-16.2	60.3	309.3				63.6
UARS	HALOE	92	3	27	9	35	47	196	10	24	43	52.9	262.2	-14.8	-22.9	62.4	302.1	436	2	40	
ATLAS	MAS	92	3	27	12	16	16	2	23	2	36	52.0	313.9	-90.0	-16.2	65.3	296.1				60.8
UARS	HALOE	92	3	27	11	12	2	196	12	0	58	53.0	238.0	-15.2	-22.9	62.5	277.9	391	2	34	
ATLAS	MAS	92	3	27	13	46	41	3	0	33	1	52.1	291.1	-90.0	-16.2	65.4	273.3				60.9
UARS	HALOE	92	3	27	12	48	17	196	13	37	12	53.0	213.8	-15.5	-22.9	62.6	253.8	339	2	28	
ATLAS	MAS	92	3	27	15	16	52	3	2	3	12	51.6	267.0	-90.0	-16.2	64.8	249.0				61.4
UARS	HALOE	92	3	27	14	24	31	196	15	13	28	53.1	189.6	-15.8	-22.9	62.7	229.7	294	2	22	
ATLAS	MAS	92	3	27	16	47	17	3	3	33	37	51.7	244.2	-90.0	-16.2	64.9	226.3				61.5
UARS	HALOE	92	3	27	16	0	46	196	16	49	42	53.1	165.4	-16.1	-22.9	62.8	205.5	240	2	16	
ATLAS	MAS	92	3	27	18	17	28	3	5	3	48	51.3	220.1	-90.0	-16.2	64.3	202.0				62.0
UARS	HALOE	92	3	27	17	37	0	196	18	25	56	53.2	141.2	-16.4	-22.9	62.9	181.4	195	2	10	
ATLAS	MAS	92	3	27	19	47	53	3	6	34	13	51.3	197.3	-90.0	-16.2	64.4	179.2				62.1

Table 6. Continued.

sat.	instrument	gmt yr mo da hr mn sc	time into mission da hr mn sc	sub satellite lat lon	viewing angle beta alpha	observed point lat lon	miss dist km	miss time hr mn	solar zenith angle
UARS	HALOE	92 3 27 19 13 15	196 20 2 11	53.2 117.0	-16.7 -22.9	63.0 157.2	140	2 4	
ATLAS	MAS	92 3 27 21 18 4	3 8 4 24	50.9 173.2	-90.0 -16.2	63.8 155.0			62.6
UARS	HALOE	92 3 27 20 49 30	196 21 38 25	53.3 92.8	-17.0 -22.9	63.1 133.1	94	1 58	
ATLAS	MAS	92 3 27 22 48 29	3 9 34 49	51.0 150.4	-90.0 -16.2	63.9 132.2			62.7
UARS	HALOE	92 3 27 22 25 44	196 23 14 40	53.4 68.6	-17.4 -22.9	63.2 108.9	44	1 52	
ATLAS	MAS	92 3 28 0 18 40	3 11 5 0	50.5 126.3	-90.0 -16.2	63.3 108.1			63.3
UARS	HALOE	92 3 28 0 1 59	197 0 50 55	53.4 44.4	-17.7 -22.9	63.3 84.8	25	1 47	
ATLAS	MAS	92 3 28 1 49 5	3 12 35 25	50.6 103.5	-90.0 -16.2	63.4 85.3			63.4
UARS	HALOE	92 3 28 1 38 14	197 2 27 10	53.5 20.2	-18.0 -22.9	63.4 60.7	77	1 41	
ATLAS	MAS	92 3 28 3 19 16	3 14 5 36	50.1 79.5	-90.0 -16.2	62.8 61.2			64.0
UARS	HALOE	92 3 28 3 14 28	197 4 3 24	53.5 356.0	-18.3 -22.9	63.5 36.5	120	1 35	
ATLAS	MAS	92 3 28 4 49 41	3 15 36 1	50.2 56.7	-90.0 -16.2	62.9 38.4			64.1
UARS	HALOE	92 3 28 4 50 43	197 5 39 39	53.6 331.8	-18.6 -22.9	63.6 12.4	179	1 29	
ATLAS	MAS	92 3 28 6 20 7	3 17 6 27	50.3 33.9	-90.0 -16.2	63.0 15.6			64.2
UARS	HALOE	92 3 28 6 26 57	197 7 15 53	53.6 307.6	-18.9 -22.9	63.7 348.2	227	1 23	
ATLAS	MAS	92 3 28 7 50 17	3 18 36 37	49.8 9.8	-90.0 -16.2	62.3 351.5			64.8
UARS	HALOE	92 3 28 8 3 12	197 8 52 8	53.7 283.4	-19.2 -22.9	63.8 324.1	281	1 17	
ATLAS	MAS	92 3 28 9 20 43	3 20 7 3	49.9 347.0	-90.0 -16.2	62.4 328.7			64.9
UARS	HALOE	92 3 28 8 3 12	197 8 52 8	53.7 283.4	-19.2 -22.9	63.8 324.1	496	2 49	
ATLAS	MAS	92 3 28 10 52 54	3 21 39 14	53.3 333.7	-90.0 -16.2	67.2 317.0			61.6
UARS	HALOE	92 3 28 9 39 26	197 10 28 22	53.7 259.2	-19.6 -22.9	63.9 299.9	336	1 11	
ATLAS	MAS	92 3 28 10 50 53	3 21 37 13	49.4 323.0	-90.0 -16.2	61.8 304.6			65.5
UARS	HALOE	92 3 28 9 39 26	197 10 28 22	53.7 259.2	-19.6 -22.9	63.9 299.9	453	2 43	
ATLAS	MAS	92 3 28 12 23 19	3 23 9 39	53.3 311.0	-90.0 -16.2	67.3 294.3			61.7
UARS	HALOE	92 3 28 11 15 41	197 12 4 36	53.8 235.0	-19.9 -22.9	64.0 275.8	388	1 5	
ATLAS	MAS	92 3 28 12 21 19	3 23 7 39	49.5 300.2	-90.0 -16.2	61.9 281.9			65.7
UARS	HALOE	92 3 28 11 15 41	197 12 4 36	53.8 235.0	-19.9 -22.9	64.0 275.8	410	2 37	
ATLAS	MAS	92 3 28 13 53 30	4 0 39 50	53.0 286.8	-90.0 -16.2	66.7 269.7			62.3
UARS	HALOE	92 3 28 12 51 56	197 13 40 52	53.8 210.8	-20.2 -22.9	64.1 251.6	444	0 59	
ATLAS	MAS	92 3 28 13 51 44	4 0 38 4	49.6 277.4	-90.0 -16.2	62.0 259.1			65.8
UARS	HALOE	92 3 28 12 51 56	197 13 40 52	53.8 210.8	-20.2 -22.9	64.1 251.6	366	2 31	
ATLAS	MAS	92 3 28 15 23 55	4 2 10 15	53.0 264.0	-90.0 -16.2	66.8 247.0			62.3

Table 6. Continued.

sat.	instrument	gmt yr	mo	da	hr	mn	sc	time into mission da	hr	mn	sc	sub satellite lat	lon	viewing angle beta	alpha	observed point lat	lon	miss dist km	time hr	mn	solar zenith angle
UARS	HALOE	92	3	28	14	28	10	197	15	17	7	53.9	186.6	-20.5	-22.9	64.2	227.5	323	2	25	
ATLAS	MAS	92	3	28	16	54	6	4	3	40	26	52.7	239.8	-90.0	-16.2	66.3	222.5				62.9
UARS	HALOE	92	3	28	16	4	25	197	16	53	21	53.9	162.4	-20.8	-22.9	64.3	203.3	278	2	20	
ATLAS	MAS	92	3	28	18	24	31	4	5	10	51	52.7	217.0	-90.0	-16.2	66.3	199.8				63.0
UARS	HALOE	92	3	28	17	40	39	197	18	29	35	54.0	138.2	-21.1	-22.9	64.4	179.2	234	2	14	
ATLAS	MAS	92	3	28	19	54	42	4	6	41	2	52.3	192.9	-90.0	-16.2	65.8	175.4				63.6
UARS	HALOE	92	3	28	19	16	54	197	20	5	50	54.0	114.0	-21.5	-22.9	64.5	155.0	187	2	8	
ATLAS	MAS	92	3	28	21	25	7	4	8	11	27	52.4	170.1	-90.0	-16.2	65.9	152.7				63.7
UARS	HALOE	92	3	28	20	53	8	197	21	42	4	54.0	89.8	-21.8	-22.9	64.6	130.9	144	2	2	
ATLAS	MAS	92	3	28	22	55	17	4	9	41	37	52.0	145.9	-90.0	-16.2	65.3	128.3				64.3
UARS	HALOE	92	3	28	22	29	23	197	23	18	19	54.1	65.6	-22.1	-22.9	64.7	106.7	94	1	56	
ATLAS	MAS	92	3	29	0	25	43	4	11	12	3	52.0	123.1	-90.0	-16.2	65.4	105.5				64.4
UARS	HALOE	92	3	29	0	5	37	198	0	54	33	54.1	41.4	-22.4	-22.9	64.8	82.6	64	1	50	
ATLAS	MAS	92	3	29	1	55	53	4	12	42	13	51.6	99.0	-90.0	-16.2	64.8	81.2				65.0
UARS	HALOE	92	3	29	1	41	52	198	2	30	47	54.2	17.2	-22.7	-22.9	64.9	58.4	0	1	44	
ATLAS	MAS	92	3	29	3	26	19	4	14	12	39	51.7	76.2	-90.0	-16.2	64.9	58.5				65.1
UARS	HALOE	92	3	29	3	18	6	198	4	7	2	54.2	353.1	-23.0	-22.9	65.0	34.3	68	1	38	
ATLAS	MAS	92	3	29	4	56	44	4	15	43	4	51.8	53.5	-90.0	-16.2	65.0	35.7				65.2
UARS	HALOE	92	3	29	4	54	21	198	5	43	18	54.3	328.9	-23.3	-22.9	65.1	10.1	99	1	32	
ATLAS	MAS	92	3	29	6	26	55	4	17	13	15	51.3	29.3	-90.0	-16.2	64.4	11.4				65.9
UARS	HALOE	92	3	29	6	30	35	198	7	19	32	54.3	304.7	-23.7	-22.9	65.2	346.0	150	1	26	
ATLAS	MAS	92	3	29	7	57	20	4	18	43	40	51.4	6.5	-90.0	-16.2	64.5	348.7				66.0
UARS	HALOE	92	3	29	8	6	50	198	8	55	46	54.4	280.5	-24.0	-22.9	65.3	321.8	199	1	20	
ATLAS	MAS	92	3	29	9	27	31	4	20	13	51	51.0	342.4	-90.0	-16.2	63.9	324.5				66.6
UARS	HALOE	92	3	29	8	6	50	198	8	55	46	54.4	280.5	-24.0	-22.9	65.3	321.8	483	2	53	
ATLAS	MAS	92	3	29	10	59	57	4	21	46	17	54.5	331.1	-90.0	-16.2	69.0	315.9				62.3
UARS	HALOE	92	3	29	9	43	4	198	10	32	1	54.4	256.3	-24.3	-22.9	65.3	297.6	246	1	14	
ATLAS	MAS	92	3	29	10	57	56	4	21	44	16	51.0	319.7	-90.0	-16.2	64.0	301.7				66.7
UARS	HALOE	92	3	29	9	43	4	198	10	32	1	54.4	256.3	-24.3	-22.9	65.3	297.6	448	2	47	
ATLAS	MAS	92	3	29	12	30	7	4	23	16	27	54.1	306.8	-90.0	-16.2	68.5	291.2				62.9
UARS	HALOE	92	3	29	11	19	19	198	12	8	15	54.4	232.1	-24.6	-22.9	65.4	273.5	301	1	8	
ATLAS	MAS	92	3	29	12	28	7	4	23	14	27	50.6	295.6	-90.0	-16.2	63.4	277.5				67.4

Table 6. Continued.

sat.	instrument	gmt yr	mo	da	hr	mn	sc	time into mission da	hr	mn	sc	sub satellite lat	lon	viewing angle beta	alpha	observed point lat	lon	miss dist km	time hr	mn	solar zenith angle
UARS	HALOE	92	3	29	11	19	19	198	12	8	15	54.4	232.1	-24.6	-22.9	65.4	273.5	408	2	41	
ATLAS	MAS	92	3	29	14	0	33	5	0	46	53	54.2	284.1	-90.0	-16.2	68.5	268.5				63.0
UARS	HALOE	92	3	29	12	55	33	198	13	44	30	54.5	207.9	-24.9	-22.9	65.5	249.3	347	1	2	
ATLAS	MAS	92	3	29	13	58	32	5	0	44	52	50.7	272.8	-90.0	-16.2	63.5	254.7				67.5
UARS	HALOE	92	3	29	12	55	33	198	13	44	30	54.5	207.9	-24.9	-22.9	65.5	249.3	371	2	35	
ATLAS	MAS	92	3	29	15	30	43	5	2	17	3	53.9	259.8	-90.0	-16.2	68.1	243.8				63.6
UARS	HALOE	92	3	29	14	31	48	198	15	20	44	54.5	183.7	-25.2	-22.9	65.6	225.2	398	0	57	
ATLAS	MAS	92	3	29	15	28	58	5	2	15	18	50.7	250.0	-90.0	-16.2	63.5	232.0				67.6
UARS	HALOE	92	3	29	14	31	48	198	15	20	44	54.5	183.7	-25.2	-22.9	65.6	225.2	330	2	29	
ATLAS	MAS	92	3	29	17	1	9	5	3	47	29	53.9	237.0	-90.0	-16.2	68.1	221.1				63.7
UARS	HALOE	92	3	29	16	8	2	198	16	56	58	54.6	159.5	-25.5	-22.9	65.7	201.0	450	0	51	
ATLAS	MAS	92	3	29	16	59	8	5	3	45	28	50.3	225.9	-90.0	-16.2	62.9	207.8				68.3
UARS	HALOE	92	3	29	16	8	2	198	16	56	58	54.6	159.5	-25.5	-22.9	65.7	201.0	292	2	23	
ATLAS	MAS	92	3	29	18	31	19	5	5	17	39	53.6	212.8	-90.0	-16.2	67.6	196.4				64.3
UARS	HALOE	92	3	29	17	44	17	198	18	33	13	54.6	135.3	-25.9	-22.9	65.8	176.9	250	2	17	
ATLAS	MAS	92	3	29	20	1	45	5	6	48	5	53.6	190.0	-90.0	-16.2	67.7	173.7				64.4
UARS	HALOE	92	3	29	19	20	31	198	20	9	27	54.7	111.1	-26.2	-22.9	65.9	152.7	211	2	11	
ATLAS	MAS	92	3	29	21	31	55	5	8	18	15	53.3	165.8	-90.0	-16.2	67.2	149.1				65.1
UARS	HALOE	92	3	29	20	56	46	198	21	45	42	54.7	86.9	-26.5	-22.9	66.0	128.5	168	2	5	
ATLAS	MAS	92	3	29	23	2	21	5	9	48	41	53.3	143.0	-90.0	-16.2	67.2	126.4				65.1
UARS	HALOE	92	3	29	22	33	0	198	23	21	56	54.7	62.7	-26.8	-22.9	66.1	104.4	130	1	59	
ATLAS	MAS	92	3	30	0	32	31	5	11	18	51	53.0	118.8	-90.0	-16.2	66.7	101.9				65.8
UARS	HALOE	92	3	30	0	9	15	199	0	58	11	54.8	38.5	-27.1	-22.9	66.2	80.2	83	1	53	
ATLAS	MAS	92	3	30	2	2	57	5	12	49	17	53.0	96.0	-90.0	-16.2	66.8	79.2				65.9
UARS	HALOE	92	3	30	1	45	29	199	2	34	25	54.8	14.3	-27.4	-22.9	66.2	56.1	60	1	47	
ATLAS	MAS	92	3	30	3	33	7	5	14	19	27	52.6	71.9	-90.0	-16.2	66.2	54.7				66.6
UARS	HALOE	92	3	30	3	21	44	199	4	10	39	54.9	350.1	-27.7	-22.9	66.3	31.9	3	1	41	
ATLAS	MAS	92	3	30	5	3	33	5	15	49	53	52.7	49.1	-90.0	-16.2	66.3	32.0				66.7
UARS	HALOE	92	3	30	4	57	58	199	5	46	54	54.9	325.9	-28.1	-22.9	66.4	7.7	41	1	34	
ATLAS	MAS	92	3	30	6	32	19	5	17	18	39	52.6	26.3	-90.0	-16.1	66.1	8.1				67.6
UARS	HALOE	92	3	30	6	34	13	199	7	23	8	54.9	301.7	-28.4	-22.9	66.5	343.6	90	1	28	
ATLAS	MAS	92	3	30	8	2	40	5	18	49	0	52.6	3.5	-90.0	-16.1	66.2	345.4				67.7

Table 6. Continued.

sat.	instrument	gmt yr	mo	da	hr	mn	sc	time into mission da	hr	mn	sc	sub satellite lat	lon	viewing angle beta	alpha	observed point lat	lon	miss dist km	time hr	mn	solar zenith angle
UARS	HALOE	92	3	30	6	34	13	199	7	23	8	54.9	301.7	-28.4	-22.9	66.5	343.6	487	3	0	
ATLAS	MAS	92	3	30	9	34	47	5	20	21	7	55.3	351.4	-90.0	-16.1	70.2	337.1				63.4
UARS	HALOE	92	3	30	8	10	27	199	8	59	23	55.0	277.5	-28.7	-22.9	66.6	319.4	132	1	22	
ATLAS	MAS	92	3	30	9	32	46	5	20	19	6	52.2	339.4	-90.0	-16.1	65.6	321.0				68.4
UARS	HALOE	92	3	30	8	10	27	199	8	59	23	55.0	277.5	-28.7	-22.9	66.6	319.4	452	2	54	
ATLAS	MAS	92	3	30	11	5	8	5	21	51	28	55.3	328.7	-90.0	-16.1	70.2	314.4				63.5
UARS	HALOE	92	3	30	9	46	41	199	10	35	37	55.0	253.3	-29.0	-22.9	66.7	295.2	176	1	16	
ATLAS	MAS	92	3	30	11	3	8	5	21	49	28	52.3	316.6	-90.0	-16.1	65.7	298.3				68.5
UARS	HALOE	92	3	30	9	46	41	199	10	35	37	55.0	253.3	-29.0	-22.9	66.7	295.2	422	2	48	
ATLAS	MAS	92	3	30	12	35	15	5	23	21	35	55.0	304.4	-90.0	-16.1	69.8	289.4				64.1
UARS	HALOE	92	3	30	11	22	56	199	12	11	51	55.0	229.1	-29.3	-22.9	66.8	271.1	224	1	10	
ATLAS	MAS	92	3	30	12	33	14	5	23	19	34	51.9	292.5	-90.0	-16.1	65.1	273.9				69.2
UARS	HALOE	92	3	30	11	22	56	199	12	11	51	55.0	229.1	-29.3	-22.9	66.8	271.1	387	2	42	
ATLAS	MAS	92	3	30	14	5	36	6	0	51	56	55.1	281.6	-90.0	-16.1	69.9	266.8				64.2
UARS	HALOE	92	3	30	12	59	10	199	13	48	6	55.1	204.9	-29.6	-22.9	66.9	246.9	267	1	4	
ATLAS	MAS	92	3	30	14	3	36	6	0	49	56	52.0	269.7	-90.0	-16.1	65.2	251.2				69.3
UARS	HALOE	92	3	30	12	59	10	199	13	48	6	55.1	204.9	-29.6	-22.9	66.9	246.9	355	2	36	
ATLAS	MAS	92	3	30	15	35	43	6	2	22	3	54.8	257.3	-90.0	-16.1	69.4	241.9				64.9
UARS	HALOE	92	3	30	14	35	25	199	15	24	20	55.1	180.7	-29.9	-22.9	66.9	222.7	317	0	58	
ATLAS	MAS	92	3	30	15	33	57	6	2	20	17	52.0	247.0	-90.0	-16.1	65.3	228.5				69.4
UARS	HALOE	92	3	30	14	35	25	199	15	24	20	55.1	180.7	-29.9	-22.9	66.9	222.7	320	2	30	
ATLAS	MAS	92	3	30	17	6	4	6	3	52	24	54.9	234.6	-90.0	-16.1	69.5	219.2				65.0
UARS	HALOE	92	3	30	16	11	39	199	17	0	35	55.2	156.5	-30.3	-22.9	67.0	198.6	362	0	52	
ATLAS	MAS	92	3	30	17	4	4	6	3	50	24	51.6	222.9	-90.0	-16.1	64.7	204.2				70.2
UARS	HALOE	92	3	30	16	11	39	199	17	0	35	55.2	156.5	-30.3	-22.9	67.0	198.6	285	2	24	
ATLAS	MAS	92	3	30	18	36	11	6	5	22	31	54.6	210.3	-90.0	-16.1	69.0	194.4				65.7
UARS	HALOE	92	3	30	17	47	54	199	18	36	49	55.2	132.3	-30.6	-22.9	67.1	174.4	409	0	46	
ATLAS	MAS	92	3	30	18	34	25	6	5	20	45	51.7	200.1	-90.0	-16.1	64.8	181.4				70.3
UARS	HALOE	92	3	30	17	47	54	199	18	36	49	55.2	132.3	-30.6	-22.9	67.1	174.4	250	2	18	
ATLAS	MAS	92	3	30	20	6	32	6	6	52	52	54.6	187.6	-90.0	-16.1	69.1	171.7				65.7
UARS	HALOE	92	3	30	19	24	8	199	20	13	3	55.2	108.1	-30.9	-22.9	67.2	150.2	459	0	40	
ATLAS	MAS	92	3	30	20	4	32	6	6	50	52	51.2	176.0	-90.0	-16.1	64.2	157.2				71.0

Table 6. Continued.

sat.	instrument	gmt yr mo da hr mn sc	time into mission da hr mn sc	sub satellite lat lon	viewing angle beta alpha	observed point lat lon	miss dist km	miss time hr mn	solar zenith angle
UARS	HALOE	92 3 30 19 24 8	199 20 13 3	55.2 108.1	-30.9 -22.9	67.2 150.2	213	2 12	
ATLAS	MAS	92 3 30 21 36 39	6 8 22 59	54.3 163.3	-90.0 -16.1	68.6 146.9			66.5
UARS	HALOE	92 3 30 20 26 18	199 21 15 14	-39.3 350.9	-148.9 -22.9	-41.1 320.9	123	3 27	
ATLAS	MAS	92 3 30 23 53 26	6 10 39 46	-55.9 317.2	-90.0 -16.1	-40.1 321.7			116.7
UARS	HALOE	92 3 30 21 0 22	199 21 49 18	55.3 83.9	-31.2 -22.9	67.3 126.1	177	2 6	
ATLAS	MAS	92 3 30 23 7 0	6 9 53 20	54.4 140.5	-90.0 -16.1	68.7 124.2			66.5
UARS	HALOE	92 3 30 22 2 35	199 22 51 30	-39.1 326.8	-148.6 -22.9	-40.8 296.9	121	3 20	
ATLAS	MAS	92 3 31 1 23 18	6 12 9 38	-55.4 291.2	-90.0 -16.1	-39.8 296.6			115.3
UARS	HALOE	92 3 30 22 36 37	199 23 25 32	55.3 59.7	-31.5 -22.9	67.4 101.9	139	2 0	
ATLAS	MAS	92 3 31 0 37 7	6 11 23 27	54.0 116.3	-90.0 -16.1	68.2 99.5			67.3
UARS	HALOE	92 3 30 23 38 52	200 0 27 47	-38.9 302.6	-148.3 -22.9	-40.6 272.8	114	3 14	
ATLAS	MAS	92 3 31 2 53 24	6 13 39 44	-55.1 266.9	-90.0 -16.1	-39.6 272.6			114.6
UARS	HALOE	92 3 31 0 12 51	200 1 1 47	55.3 35.6	-31.8 -22.9	67.4 77.7	103	1 54	
ATLAS	MAS	92 3 31 2 7 28	6 12 53 48	54.1 93.5	-90.0 -16.1	68.3 76.8			67.4
UARS	HALOE	92 3 31 1 15 8	200 2 4 4	-38.7 278.5	-148.0 -22.9	-40.4 248.7	109	3 8	
ATLAS	MAS	92 3 31 4 23 30	6 15 9 50	-54.8 242.5	-90.0 -16.1	-39.4 248.7			113.9
UARS	HALOE	92 3 31 1 49 6	200 2 38 1	55.4 11.4	-32.1 -22.9	67.5 53.6	66	1 48	
ATLAS	MAS	92 3 31 3 37 35	6 14 23 55	53.7 69.3	-90.0 -16.1	67.8 52.2			68.1
UARS	HALOE	92 3 31 2 51 25	200 3 40 21	-38.5 254.3	-147.7 -22.9	-40.1 224.7	107	3 2	
ATLAS	MAS	92 3 31 5 53 37	6 16 39 57	-54.6 218.2	-90.0 -16.1	-39.2 224.8			113.1
UARS	HALOE	92 3 31 3 25 20	200 4 14 16	55.4 347.2	-32.5 -22.9	67.6 29.4	30	1 42	
ATLAS	MAS	92 3 31 5 7 56	6 15 54 16	53.8 46.6	-90.0 -16.1	67.9 29.5			68.2
UARS	HALOE	92 3 31 3 25 20	200 4 14 16	55.4 347.2	-32.5 -22.9	67.6 29.4	478	3 14	
ATLAS	MAS	92 3 31 6 40 18	6 17 26 38	56.2 36.7	-90.0 -16.1	71.7 25.9			62.9
UARS	HALOE	92 3 31 4 27 42	200 5 16 38	-38.3 230.2	-147.3 -22.9	-39.9 200.6	107	2 56	
ATLAS	MAS	92 3 31 7 23 43	6 18 10 3	-54.2 194.0	-90.0 -16.1	-38.9 200.9			112.4
UARS	HALOE	92 3 31 5 1 34	200 5 50 30	55.4 323.0	-32.8 -22.9	67.7 5.2	39	1 36	
ATLAS	MAS	92 3 31 6 38 2	6 17 24 22	53.5 22.3	-90.0 -16.1	67.4 4.9			68.9
UARS	HALOE	92 3 31 5 1 34	200 5 50 30	55.4 323.0	-32.8 -22.9	67.7 5.2	452	3 8	
ATLAS	MAS	92 3 31 8 10 24	6 18 56 44	56.0 12.3	-90.0 -16.1	71.4 0.6			63.6
UARS	HALOE	92 3 31 6 3 59	200 6 52 55	-38.1 206.0	-147.0 -22.9	-39.7 176.5	110	2 49	
ATLAS	MAS	92 3 31 8 53 50	6 19 40 10	-53.9 169.7	-90.0 -16.1	-38.7 176.9			111.6

Table 6. Continued.

sat.	instrument	gmt yr	mo	da	hr	mn	sc	time into mission da	hr	mn	sc	sub satellite lat	lon	viewing angle beta	alpha	observed point lat	lon	miss dist km	time hr	mn	solar zenith angle
UARS	HALOE	92	3	31	6	37	49	200	7	26	44	55.5	298.8	-33.1	-22.9	67.8	341.0	60	1	30	
ATLAS	MAS	92	3	31	8	8	24	6	18	54	44	53.5	359.6	-90.0	-16.1	67.4	342.2				69.0
UARS	HALOE	92	3	31	6	37	49	200	7	26	44	55.5	298.8	-33.1	-22.9	67.8	341.0	428	3	2	
ATLAS	MAS	92	3	31	9	40	46	6	20	27	6	56.1	349.5	-90.0	-16.1	71.5	338.0				63.7
UARS	HALOE	92	3	31	7	40	16	200	8	29	12	-37.9	181.8	-146.7	-22.9	-39.4	152.5	117	2	43	
ATLAS	MAS	92	3	31	10	23	56	6	21	10	16	-53.6	145.5	-90.0	-16.1	-38.5	153.0				110.8
UARS	HALOE	92	3	31	8	14	3	200	9	2	59	55.5	274.6	-33.4	-22.9	67.9	316.9	109	1	24	
ATLAS	MAS	92	3	31	9	38	30	6	20	24	50	53.2	335.4	-90.0	-16.1	66.9	317.6				69.8
UARS	HALOE	92	3	31	8	14	3	200	9	2	59	55.5	274.6	-33.4	-22.9	67.9	316.9	399	2	56	
ATLAS	MAS	92	3	31	11	10	52	6	21	57	12	55.9	325.2	-90.0	-16.1	71.1	312.7				64.4
UARS	HALOE	92	3	31	9	16	34	200	10	5	30	-37.7	157.7	-146.4	-22.9	-39.2	128.4	125	2	37	
ATLAS	MAS	92	3	31	11	54	3	6	22	40	23	-53.2	121.3	-90.0	-16.1	-38.2	129.1				110.1
UARS	HALOE	92	3	31	9	50	18	200	10	39	13	55.5	250.4	-33.7	-22.9	67.9	292.7	141	1	18	
ATLAS	MAS	92	3	31	11	8	52	6	21	55	12	53.2	312.6	-90.0	-16.1	67.0	294.9				69.9
UARS	HALOE	92	3	31	9	50	18	200	10	39	13	55.5	250.4	-33.7	-22.9	67.9	292.7	375	2	50	
ATLAS	MAS	92	3	31	12	40	59	6	23	27	19	55.6	300.8	-90.0	-16.1	70.8	287.5				65.1
UARS	HALOE	92	3	31	10	52	51	200	11	41	47	-37.5	133.5	-146.1	-22.9	-38.9	104.3	137	2	31	
ATLAS	MAS	92	3	31	13	24	9	7	0	10	29	-52.9	97.1	-90.0	-16.1	-37.9	105.3				109.3
UARS	HALOE	92	3	31	11	26	32	200	12	15	28	55.6	226.2	-34.0	-22.9	68.0	268.5	189	1	12	
ATLAS	MAS	92	3	31	12	39	13	6	23	25	33	53.3	289.9	-90.0	-16.1	67.1	272.2				70.0
UARS	HALOE	92	3	31	11	26	32	200	12	15	28	55.6	226.2	-34.0	-22.9	68.0	268.5	343	2	44	
ATLAS	MAS	92	3	31	14	11	20	7	0	57	40	55.7	278.1	-90.0	-16.1	70.8	264.9				65.2
UARS	HALOE	92	3	31	12	29	8	200	13	18	4	-37.3	109.4	-145.8	-22.9	-38.7	80.3	151	2	25	
ATLAS	MAS	92	3	31	14	54	16	7	1	40	36	-52.5	72.9	-90.0	-16.1	-37.7	81.4				108.5
UARS	HALOE	92	3	31	13	2	47	200	13	51	42	55.6	202.0	-34.3	-22.9	68.1	244.4	226	1	6	
ATLAS	MAS	92	3	31	14	9	20	7	0	55	40	52.9	265.7	-90.0	-16.1	66.5	247.7				70.8
UARS	HALOE	92	3	31	13	2	47	200	13	51	42	55.6	202.0	-34.3	-22.9	68.1	244.4	317	2	38	
ATLAS	MAS	92	3	31	15	41	27	7	2	27	47	55.4	253.7	-90.0	-16.1	70.4	239.8				65.9
UARS	HALOE	92	3	31	14	5	25	200	14	54	21	-37.0	85.2	-145.5	-22.9	-38.4	56.2	160	2	18	
ATLAS	MAS	92	3	31	16	24	7	7	3	10	27	-51.6	47.4	-90.0	-16.1	-37.0	56.5				106.9
UARS	HALOE	92	3	31	14	39	1	200	15	27	56	55.6	177.8	-34.6	-22.9	68.2	220.2	270	1	0	
ATLAS	MAS	92	3	31	15	39	41	7	2	26	1	52.9	242.9	-90.0	-16.1	66.6	225.0				70.9

Table 6. Continued.

sat.	instrument	gmt yr mo da hr mn sc	time into mission da hr mn sc	sub satellite lat lon	viewing angle beta alpha	observed point lat lon	miss dist km	miss time hr mn	solar zenith angle
UARS	HALOE	92 3 31 14 39 1	200 15 27 56	55.6 177.8	-34.6 -22.9	68.2 220.2	284	2 32	
ATLAS	MAS	92 3 31 17 11 48	7 3 58 8	55.5 231.0	-90.0 -16.1	70.5 217.2			66.0
UARS	HALOE	92 3 31 15 41 42	200 16 30 38	-36.8 61.1	-145.1 -22.9	-38.2 32.1	171	2 12	
ATLAS	MAS	92 3 31 17 54 13	7 4 40 33	-51.2 23.3	-90.0 -16.1	-36.7 32.6			106.1
UARS	HALOE	92 3 31 16 15 15	200 17 4 11	55.6 153.6	-35.0 -22.9	68.3 196.0	313	0 54	
ATLAS	MAS	92 3 31 17 9 48	7 3 56 8	52.6 218.8	-90.0 -16.1	66.1 200.6			71.7
UARS	HALOE	92 3 31 16 15 15	200 17 4 11	55.6 153.6	-35.0 -22.9	68.3 196.0	256	2 26	
ATLAS	MAS	92 3 31 18 41 55	7 5 28 15	55.2 206.6	-90.0 -16.1	70.1 192.1			66.7
UARS	HALOE	92 3 31 17 18 0	200 18 6 56	-36.6 36.9	-144.8 -22.9	-37.9 8.1	185	2 6	
ATLAS	MAS	92 3 31 19 24 20	7 6 10 40	-50.7 359.2	-90.0 -16.1	-36.4 8.8			105.3
UARS	HALOE	92 3 31 17 51 30	200 18 40 25	55.7 129.4	-35.3 -22.9	68.3 171.8	356	0 48	
ATLAS	MAS	92 3 31 18 40 9	7 5 26 29	52.6 196.0	-90.0 -16.1	66.1 177.9			71.8
UARS	HALOE	92 3 31 17 51 30	200 18 40 25	55.7 129.4	-35.3 -22.9	68.3 171.8	222	2 20	
ATLAS	MAS	92 3 31 20 12 16	7 6 58 36	55.3 183.9	-90.0 -16.1	70.2 169.5			66.8
UARS	HALOE	92 3 31 18 54 17	200 19 43 13	-36.4 12.7	-144.5 -22.9	-37.7 344.0	202	2 0	
ATLAS	MAS	92 3 31 20 54 26	7 7 40 46	-50.3 335.1	-90.0 -16.1	-36.0 345.0			104.4
UARS	HALOE	92 3 31 19 27 44	200 20 16 40	55.7 105.2	-35.6 -22.9	68.4 147.6	403	0 42	
ATLAS	MAS	92 3 31 20 10 31	7 6 56 51	52.7 173.2	-90.0 -16.1	66.2 155.2			71.8
UARS	HALOE	92 3 31 19 27 44	200 20 16 40	55.7 105.2	-35.6 -22.9	68.4 147.6	192	2 14	
ATLAS	MAS	92 3 31 21 42 23	7 8 28 43	55.0 159.6	-90.0 -16.1	69.7 144.5			67.6
UARS	HALOE	92 3 31 20 30 34	200 21 19 30	-36.2 348.6	-144.2 -22.9	-37.4 319.9	222	1 53	
ATLAS	MAS	92 3 31 22 24 33	7 9 10 53	-49.8 311.1	-90.0 -16.1	-35.7 321.1			103.6
UARS	HALOE	92 3 31 20 30 34	200 21 19 30	-36.2 348.6	-144.2 -22.9	-37.4 319.9	360	3 29	
ATLAS	MAS	92 3 31 23 59 40	7 10 46 0	-56.6 317.2	-90.0 -16.1	-40.6 319.6			117.3
UARS	HALOE	92 3 31 21 3 58	200 21 52 54	55.7 81.0	-35.9 -22.9	68.5 123.5	444	0 36	
ATLAS	MAS	92 3 31 21 40 37	7 8 26 57	52.3 149.1	-90.0 -16.1	65.7 130.7			72.7
UARS	HALOE	92 3 31 21 3 58	200 21 52 54	55.7 81.0	-35.9 -22.9	68.5 123.5	158	2 8	
ATLAS	MAS	92 3 31 23 12 44	7 9 59 4	55.0 136.8	-90.0 -16.1	69.8 121.9			67.7
UARS	HALOE	92 3 31 22 6 51	200 22 55 47	-36.0 324.4	-143.9 -22.9	-37.2 295.9	243	1 47	
ATLAS	MAS	92 3 31 23 54 39	7 10 40 59	-49.4 287.1	-90.0 -16.1	-35.3 297.3			102.7
UARS	HALOE	92 3 31 22 6 51	200 22 55 47	-36.0 324.4	-143.9 -22.9	-37.2 295.9	378	3 22	
ATLAS	MAS	92 4 1 1 29 47	7 12 16 7	-56.5 292.7	-90.0 -16.1	-40.6 295.6			116.5

Table 6. Continued.

sat.	instrument	gmt yr	mo	da	hr	mn	sc	time into mission da	hr	mn	sc	sub satellite lat	lon	viewing angle beta	alpha	observed point lat	lon	miss dist km	time hr	mn	solar zenith angle
UARS	HALOE	92	3	31	22	40	13	200	23	29	9	55.8	56.8	-36.2	-22.9	68.6	99.3	127	2	2	
ATLAS	MAS	92	4	1	0	42	51	7	11	29	11	54.8	112.5	-90.0	-16.1	69.4	97.0				68.4
UARS	HALOE	92	3	31	23	43	9	201	0	32	6	-35.7	300.3	-143.6	-22.9	-36.9	271.8	267	1	41	
ATLAS	MAS	92	4	1	1	24	46	7	12	11	6	-48.9	263.1	-90.0	-16.1	-34.9	273.5				101.9
UARS	HALOE	92	3	31	23	43	9	201	0	32	6	-35.7	300.3	-143.6	-22.9	-36.9	271.8	396	3	16	
ATLAS	MAS	92	4	1	2	59	53	7	13	46	13	-56.4	268.3	-90.0	-16.1	-40.4	271.6				115.8
UARS	HALOE	92	4	1	0	16	27	201	1	5	23	55.8	32.6	-36.5	-22.9	68.6	75.1	92	1	56	
ATLAS	MAS	92	4	1	2	13	12	7	12	59	32	54.8	89.8	-90.0	-16.1	69.4	74.3				68.5
UARS	HALOE	92	4	1	0	16	27	201	1	5	23	55.8	32.6	-36.5	-22.9	68.6	75.1	440	3	29	
ATLAS	MAS	92	4	1	3	45	34	7	14	31	54	56.7	80.4	-90.0	-16.1	72.5	73.0				62.8
UARS	HALOE	92	4	1	1	19	26	201	2	8	23	-35.5	276.1	-143.3	-22.9	-36.6	247.7	293	1	35	
ATLAS	MAS	92	4	1	2	54	52	7	13	41	12	-48.4	239.2	-90.0	-16.1	-34.6	249.7				101.0
UARS	HALOE	92	4	1	1	19	26	201	2	8	23	-35.5	276.1	-143.3	-22.9	-36.6	247.7	410	3	10	
ATLAS	MAS	92	4	1	4	29	45	7	15	16	5	-56.0	242.2	-90.0	-16.1	-40.2	246.5				114.3
UARS	HALOE	92	4	1	1	52	42	201	2	41	37	55.8	8.4	-36.8	-22.9	68.7	50.9	64	1	50	
ATLAS	MAS	92	4	1	3	43	19	7	14	29	39	54.5	65.5	-90.0	-16.1	69.0	49.5				69.3
UARS	HALOE	92	4	1	1	52	42	201	2	41	37	55.8	8.4	-36.8	-22.9	68.7	50.9	420	3	22	
ATLAS	MAS	92	4	1	5	15	41	7	16	2	1	56.6	56.0	-90.0	-16.1	72.3	47.5				63.6
UARS	HALOE	92	4	1	2	55	44	201	3	44	40	-35.3	252.0	-142.9	-22.9	-36.4	223.7	320	1	28	
ATLAS	MAS	92	4	1	4	24	43	7	15	11	3	-47.3	214.1	-90.0	-16.1	-33.7	225.0				99.3
UARS	HALOE	92	4	1	2	55	44	201	3	44	40	-35.3	252.0	-142.9	-22.9	-36.4	223.7	420	3	4	
ATLAS	MAS	92	4	1	5	59	51	7	16	46	11	-55.8	217.8	-90.0	-16.1	-40.0	222.5				113.5
UARS	HALOE	92	4	1	3	28	56	201	4	17	52	55.8	344.2	-37.2	-22.9	68.8	26.7	26	1	44	
ATLAS	MAS	92	4	1	5	13	40	7	16	0	0	54.6	42.8	-90.0	-16.1	69.0	26.8				69.4
UARS	HALOE	92	4	1	3	28	56	201	4	17	52	55.8	344.2	-37.2	-22.9	68.8	26.7	401	3	17	
ATLAS	MAS	92	4	1	6	46	2	7	17	32	22	56.6	33.3	-90.0	-16.1	72.4	24.9				63.6
UARS	HALOE	92	4	1	4	32	1	201	5	20	58	-35.0	227.8	-142.6	-22.9	-36.1	199.6	346	1	22	
ATLAS	MAS	92	4	1	5	54	50	7	16	41	10	-46.8	190.2	-90.0	-16.1	-33.3	201.3				98.5
UARS	HALOE	92	4	1	4	32	1	201	5	20	58	-35.0	227.8	-142.6	-22.9	-36.1	199.6	430	2	57	
ATLAS	MAS	92	4	1	7	29	57	7	18	16	17	-55.5	193.5	-90.0	-16.1	-39.9	198.6				112.7
UARS	HALOE	92	4	1	5	5	10	201	5	54	6	55.9	320.0	-37.5	-22.9	68.9	2.6	41	1	38	
ATLAS	MAS	92	4	1	6	43	46	7	17	30	6	54.2	18.5	-90.0	-16.1	68.6	2.0				70.2

Table 6. Continued.

sat.	instrument	gmt yr mo da hr mn sc	time into mission da hr mn sc	sub satellite lat lon	viewing angle beta alpha	observed point lat lon	miss dist km	miss time hr mn	solar zenith angle
UARS	HALOE	92 4 1 5 5 10	201 5 54 6	55.9 320.0	-37.5 -22.9	68.9 2.6	379	3 10	
ATLAS	MAS	92 4 1 8 16 8	7 19 2 28	56.4 8.8	-90.0 -16.1	72.1 359.4			64.4
UARS	HALOE	92 4 1 6 8 19	201 6 57 15	-34.8 203.7	-142.3 -22.9	-35.8 175.5	374	1 16	
ATLAS	MAS	92 4 1 7 24 56	7 18 11 16	-46.2 166.3	-90.0 -16.1	-32.9 177.5			97.6
UARS	HALOE	92 4 1 6 8 19	201 6 57 15	-34.8 203.7	-142.3 -22.9	-35.8 175.5	439	2 51	
ATLAS	MAS	92 4 1 9 0 4	7 19 46 24	-55.3 169.1	-90.0 -16.1	-39.7 174.6			111.9
UARS	HALOE	92 4 1 6 41 25	201 7 30 21	55.9 295.8	-37.8 -22.9	69.0 338.4	53	1 32	
ATLAS	MAS	92 4 1 8 14 8	7 19 0 28	54.3 355.7	-90.0 -16.1	68.6 339.4			70.3
UARS	HALOE	92 4 1 6 41 25	201 7 30 21	55.9 295.8	-37.8 -22.9	69.0 338.4	360	3 5	
ATLAS	MAS	92 4 1 9 46 30	7 20 32 50	56.5 346.1	-90.0 -16.1	72.2 336.9			64.4
UARS	HALOE	92 4 1 7 44 37	201 8 33 32	-34.6 179.5	-142.0 -22.9	-35.5 151.5	405	1 10	
ATLAS	MAS	92 4 1 8 55 3	7 19 41 23	-45.7 142.4	-90.0 -16.1	-32.4 153.8			96.7
UARS	HALOE	92 4 1 7 44 37	201 8 33 32	-34.6 179.5	-142.0 -22.9	-35.5 151.5	447	2 45	
ATLAS	MAS	92 4 1 10 30 10	7 21 16 30	-55.0 144.8	-90.0 -16.1	-39.5 150.7			111.1
UARS	HALOE	92 4 1 8 17 39	201 9 6 35	55.9 271.6	-38.1 -22.9	69.0 314.2	100	1 26	
ATLAS	MAS	92 4 1 9 44 14	7 20 30 34	54.0 331.5	-90.0 -16.1	68.1 314.6			71.1
UARS	HALOE	92 4 1 8 17 39	201 9 6 35	55.9 271.6	-38.1 -22.9	69.0 314.2	334	2 58	
ATLAS	MAS	92 4 1 11 16 36	7 22 2 56	56.3 321.7	-90.0 -16.1	71.9 311.4			65.2
UARS	HALOE	92 4 1 9 20 54	201 10 9 51	-34.3 155.4	-141.7 -22.9	-35.3 127.4	438	1 4	
ATLAS	MAS	92 4 1 10 25 9	7 21 11 29	-45.2 118.6	-90.0 -16.1	-32.0 130.1			95.7
UARS	HALOE	92 4 1 9 20 54	201 10 9 51	-34.3 155.4	-141.7 -22.9	-35.3 127.4	451	2 39	
ATLAS	MAS	92 4 1 12 0 2	7 22 46 22	-54.4 118.9	-90.0 -16.1	-39.1 125.6			109.5
UARS	HALOE	92 4 1 9 53 54	201 10 42 49	56.0 247.5	-38.4 -22.9	69.1 290.0	126	1 20	
ATLAS	MAS	92 4 1 11 14 36	7 22 0 56	54.0 308.7	-90.0 -16.1	68.2 292.0			71.2
UARS	HALOE	92 4 1 9 53 54	201 10 42 49	56.0 247.5	-38.4 -22.9	69.1 290.0	313	2 52	
ATLAS	MAS	92 4 1 12 46 43	7 23 33 3	56.1 297.3	-90.0 -16.1	71.6 286.0			66.0
UARS	HALOE	92 4 1 10 57 12	201 11 46 8	-34.1 131.2	-141.4 -22.9	-35.0 103.4	472	0 58	
ATLAS	MAS	92 4 1 11 55 16	7 22 41 36	-44.6 94.8	-90.0 -16.1	-31.6 106.4			94.8
UARS	HALOE	92 4 1 10 57 12	201 11 46 8	-34.1 131.2	-141.4 -22.9	-35.0 103.4	453	2 32	
ATLAS	MAS	92 4 1 13 30 8	8 0 16 28	-54.1 94.6	-90.0 -16.1	-38.8 101.7			108.7
UARS	HALOE	92 4 1 11 30 8	201 12 19 4	56.0 223.3	-38.7 -22.9	69.2 265.8	171	1 14	
ATLAS	MAS	92 4 1 12 44 57	7 23 31 17	54.1 286.0	-90.0 -16.1	68.3 269.3			71.2

Table 6. Continued.

sat.	instrument	gmt yr	mo	da	hr	mn	sc	time into mission da	hr	mn	sc	sub satellite lat	lon	viewing angle beta	alpha	observed point lat	lon	miss dist km	time hr	mn	solar zenith angle
UARS	HALOE	92	4	1	11	30	8	201	12	19	4	56.0	223.3	-38.7	-22.9	69.2	265.8	287	2	46	
ATLAS	MAS	92	4	1	14	17	4	8	1	3	24	56.2	274.6	-90.0	-16.1	71.6	263.5				66.0
UARS	HALOE	92	4	1	12	33	30	201	13	22	26	-33.8	107.1	-141.1	-22.9	-34.7	79.3	453	2	26	
ATLAS	MAS	92	4	1	15	0	15	8	1	46	35	-53.8	70.4	-90.0	-16.1	-38.6	77.8				107.9
UARS	HALOE	92	4	1	13	6	22	201	13	55	18	56.0	199.1	-39.0	-22.9	69.3	241.6	203	1	8	
ATLAS	MAS	92	4	1	14	15	4	8	1	1	24	53.7	261.8	-90.0	-16.1	67.8	244.6				72.1
UARS	HALOE	92	4	1	13	6	22	201	13	55	18	56.0	199.1	-39.0	-22.9	69.3	241.6	263	2	40	
ATLAS	MAS	92	4	1	15	47	11	8	2	33	31	56.0	250.2	-90.0	-16.1	71.3	238.1				66.8
UARS	HALOE	92	4	1	14	9	48	201	14	58	43	-33.6	82.9	-140.8	-22.9	-34.4	55.2	453	2	20	
ATLAS	MAS	92	4	1	16	30	21	8	3	16	41	-53.4	46.2	-90.0	-16.1	-38.3	53.9				107.0
UARS	HALOE	92	4	1	14	42	37	201	15	31	33	56.0	174.9	-39.4	-22.9	69.3	217.5	244	1	2	
ATLAS	MAS	92	4	1	15	45	25	8	2	31	45	53.8	239.0	-90.0	-16.1	67.9	221.9				72.2
UARS	HALOE	92	4	1	14	42	37	201	15	31	33	56.0	174.9	-39.4	-22.9	69.3	217.5	237	2	34	
ATLAS	MAS	92	4	1	17	17	32	8	4	3	52	56.0	227.4	-90.0	-16.1	71.4	215.6				66.9
UARS	HALOE	92	4	1	15	46	5	201	16	35	1	-33.3	58.8	-140.4	-22.9	-34.1	31.2	451	2	14	
ATLAS	MAS	92	4	1	18	0	28	8	4	46	48	-53.1	22.0	-90.0	-16.1	-38.1	30.0				106.2
UARS	HALOE	92	4	1	16	18	51	201	17	7	47	56.1	150.7	-39.7	-22.9	69.4	193.3	283	0	56	
ATLAS	MAS	92	4	1	17	15	32	8	4	1	52	53.4	214.8	-90.0	-16.1	67.3	197.3				73.0
UARS	HALOE	92	4	1	16	18	51	201	17	7	47	56.1	150.7	-39.7	-22.9	69.4	193.3	211	2	28	
ATLAS	MAS	92	4	1	18	47	39	8	5	33	59	55.8	203.0	-90.0	-16.1	71.0	190.3				67.7
UARS	HALOE	92	4	1	17	22	23	201	18	11	20	-33.1	34.6	-140.1	-22.9	-33.8	7.1	445	2	7	
ATLAS	MAS	92	4	1	19	30	19	8	6	16	39	-52.2	356.4	-90.0	-16.1	-37.5	5.0				104.5
UARS	HALOE	92	4	1	17	55	5	201	18	44	1	56.1	126.5	-40.0	-22.9	69.5	169.1	322	0	50	
ATLAS	MAS	92	4	1	18	45	53	8	5	32	13	53.5	192.0	-90.0	-16.1	67.4	174.6				73.1
UARS	HALOE	92	4	1	17	55	5	201	18	44	1	56.1	126.5	-40.0	-22.9	69.5	169.1	184	2	22	
ATLAS	MAS	92	4	1	20	18	0	8	7	4	20	55.8	180.3	-90.0	-16.1	71.1	167.7				67.8
UARS	HALOE	92	4	1	18	58	41	201	19	47	37	-32.8	10.5	-139.8	-22.9	-33.5	343.0	437	2	1	
ATLAS	MAS	92	4	1	21	0	25	8	7	46	45	-51.8	332.2	-90.0	-16.1	-37.2	341.2				103.6
UARS	HALOE	92	4	1	19	31	20	201	20	20	16	56.1	102.3	-40.3	-22.9	69.5	144.9	365	0	44	
ATLAS	MAS	92	4	1	20	16	0	8	7	2	20	53.1	167.8	-90.0	-16.1	66.9	150.1				74.0
UARS	HALOE	92	4	1	19	31	20	201	20	20	16	56.1	102.3	-40.3	-22.9	69.5	144.9	155	2	16	
ATLAS	MAS	92	4	1	21	48	7	8	8	34	27	55.6	155.9	-90.0	-16.1	70.7	142.5				68.6

Table 6. Continued.

sat.	instrument	gmt yr mo da hr mn sc	time into mission da hr mn sc	sub satellite lat lon	viewing angle beta alpha	observed point lat lon	miss dist km	miss time hr mn	solar zenith angle
UARS	HALOE	92 4 1 20 34 59	201 21 23 55	-32.6 346.3	-139.5 -22.9	-33.2 319.0	429	1 55	
ATLAS	MAS	92 4 1 22 30 32	8 9 16 52	-51.4 308.1	-90.0 -16.1	-36.9 317.3			102.8
UARS	HALOE	92 4 1 21 7 34	201 21 56 30	56.1 78.1	-40.6 -22.9	69.6 120.7	403	0 38	
ATLAS	MAS	92 4 1 21 46 21	8 8 32 41	53.2 145.1	-90.0 -16.1	67.0 127.4			74.0
UARS	HALOE	92 4 1 21 7 34	201 21 56 30	56.1 78.1	-40.6 -22.9	69.6 120.7	129	2 10	
ATLAS	MAS	92 4 1 23 18 28	8 10 4 48	55.6 133.2	-90.0 -16.1	70.8 119.9			68.7
UARS	HALOE	92 4 1 22 11 17	201 23 0 14	-32.3 322.2	-139.2 -22.9	-33.0 294.9	419	1 49	
ATLAS	MAS	92 4 2 0 0 38	8 10 46 58	-51.0 284.0	-90.0 -16.1	-36.5 293.5			101.9
UARS	HALOE	92 4 1 22 43 48	201 23 32 45	56.2 53.9	-40.9 -22.9	69.7 96.5	445	0 32	
ATLAS	MAS	92 4 1 23 16 43	8 10 3 3	53.2 122.3	-90.0 -16.1	67.0 104.7			74.1
UARS	HALOE	92 4 1 22 43 48	201 23 32 45	56.2 53.9	-40.9 -22.9	69.7 96.5	98	2 4	
ATLAS	MAS	92 4 2 0 48 35	8 11 34 55	55.4 108.9	-90.0 -16.1	70.4 94.8			69.5
UARS	HALOE	92 4 1 23 47 35	202 0 36 32	-32.0 298.0	-138.9 -22.9	-32.6 270.9	406	1 42	
ATLAS	MAS	92 4 2 1 30 30	8 12 16 50	-50.0 258.7	-90.0 -16.1	-35.8 268.6			100.2
UARS	HALOE	92 4 2 0 20 3	202 1 8 59	56.2 29.7	-41.2 -22.9	69.8 72.3	486	0 26	
ATLAS	MAS	92 4 2 0 46 49	8 11 33 9	52.9 98.1	-90.0 -16.1	66.5 80.2			75.0
UARS	HALOE	92 4 2 0 20 3	202 1 8 59	56.2 29.7	-41.2 -22.9	69.8 72.3	73	1 58	
ATLAS	MAS	92 4 2 2 18 56	8 13 5 16	55.4 86.2	-90.0 -16.1	70.4 72.2			69.5
UARS	HALOE	92 4 2 1 23 53	202 2 12 49	-31.8 273.9	-138.6 -22.9	-32.3 246.8	390	1 36	
ATLAS	MAS	92 4 2 3 0 36	8 13 46 56	-49.5 234.7	-90.0 -16.1	-35.4 244.8			99.3
UARS	HALOE	92 4 2 1 56 17	202 2 45 14	56.2 5.5	-41.5 -22.9	69.8 48.1	41	1 52	
ATLAS	MAS	92 4 2 3 49 2	8 14 35 23	55.2 61.8	-90.0 -16.1	70.0 47.2			70.4
UARS	HALOE	92 4 2 1 56 17	202 2 45 14	56.2 5.5	-41.5 -22.9	69.8 48.1	330	3 25	
ATLAS	MAS	92 4 2 5 21 24	8 16 7 44	56.8 52.6	-90.0 -16.1	72.8 46.8			64.2
UARS	HALOE	92 4 2 3 0 12	202 3 49 7	-31.5 249.7	-138.2 -22.9	-32.0 222.7	374	1 30	
ATLAS	MAS	92 4 2 4 30 42	8 15 17 2	-49.1 210.7	-90.0 -16.1	-35.1 221.0			98.3
UARS	HALOE	92 4 2 3 32 31	202 4 21 28	56.2 341.3	-41.9 -22.9	69.9 23.9	30	1 46	
ATLAS	MAS	92 4 2 5 19 24	8 16 5 44	55.2 39.1	-90.0 -16.1	70.1 24.6			70.5
UARS	HALOE	92 4 2 3 32 31	202 4 21 28	56.2 341.3	-41.9 -22.9	69.9 23.9	316	3 18	
ATLAS	MAS	92 4 2 6 51 31	8 17 37 51	56.7 28.2	-90.0 -16.1	72.6 21.2			65.0
UARS	HALOE	92 4 2 4 36 30	202 5 25 26	-31.2 225.6	-137.9 -22.9	-31.7 198.7	357	1 24	
ATLAS	MAS	92 4 2 6 0 49	8 16 47 9	-48.6 186.7	-90.0 -16.1	-34.7 197.2			97.4

Table 6. Concluded.

sat.	instrument	gmt yr	mo	da	hr	mn	sc	time into mission da	hr	mn	sc	sub satellite lat	lon	viewing angle beta	alpha	observed point lat	lon	miss dist km	time hr	mn	solar zenith angle
UARS	HALOE	92	4	2	5	8	46	202	5	57	42	56.2	317.1	-42.2	-22.9	70.0	359.7	36	1	40	
ATLAS	MAS	92	4	2	6	49	30	8	17	35	50	54.9	14.8	-90.0	-16.1	69.7	359.6				71.3
UARS	HALOE	92	4	2	5	8	46	202	5	57	42	56.2	317.1	-42.2	-22.9	70.0	359.7	298	3	13	
ATLAS	MAS	92	4	2	8	21	52	8	19	8	13	56.7	5.5	-90.0	-16.1	72.6	358.7				65.1
UARS	HALOE	92	4	2	6	12	48	202	7	1	44	-31.0	201.5	-137.6	-22.9	-31.4	174.6	337	1	17	
ATLAS	MAS	92	4	2	7	30	40	8	18	17	0	-47.5	161.6	-90.0	-16.1	-33.9	172.5				95.7
UARS	HALOE	92	4	2	6	45	0	202	7	33	57	56.3	292.9	-42.5	-22.9	70.0	335.6	64	1	34	
ATLAS	MAS	92	4	2	8	19	52	8	19	6	12	55.0	352.0	-90.0	-16.1	69.7	336.9				71.4
UARS	HALOE	92	4	2	6	45	0	202	7	33	57	56.3	292.9	-42.5	-22.9	70.0	335.6	280	3	6	
ATLAS	MAS	92	4	2	9	51	59	8	20	38	19	56.6	341.0	-90.0	-16.1	72.4	333.1				65.9
UARS	HALOE	92	4	2	7	49	6	202	8	38	2	-30.7	177.3	-137.3	-22.9	-31.1	150.6	313	1	11	
ATLAS	MAS	92	4	2	9	0	47	8	19	47	7	-47.0	137.7	-90.0	-16.1	-33.5	148.7				94.7
UARS	HALOE	92	4	2	8	21	15	202	9	10	11	56.3	268.8	-42.8	-22.9	70.1	311.4	98	1	28	
ATLAS	MAS	92	4	2	9	49	58	8	20	36	18	54.7	327.7	-90.0	-16.1	69.3	312.0				72.3
UARS	HALOE	92	4	2	8	21	15	202	9	10	11	56.3	268.8	-42.8	-22.9	70.1	311.4	263	3	1	
ATLAS	MAS	92	4	2	11	22	20	8	22	8	40	56.6	318.3	-90.0	-16.1	72.5	310.5				65.9
UARS	HALOE	92	4	2	9	25	25	202	10	14	21	-30.4	153.2	-137.0	-22.9	-30.8	126.5	289	1	5	
ATLAS	MAS	92	4	2	10	30	53	8	21	17	13	-46.4	113.8	-90.0	-16.1	-33.0	125.0				93.8
UARS	HALOE	92	4	2	9	57	29	202	10	46	24	56.3	244.6	-43.1	-22.9	70.2	287.2	127	1	22	
ATLAS	MAS	92	4	2	11	20	20	8	22	6	40	54.7	305.0	-90.0	-16.1	69.3	289.4				72.3
UARS	HALOE	92	4	2	9	57	29	202	10	46	24	56.3	244.6	-43.1	-22.9	70.2	287.2	241	2	54	
ATLAS	MAS	92	4	2	12	52	27	8	23	38	47	56.5	293.9	-90.0	-16.1	72.2	285.0				66.8
UARS	HALOE	92	4	2	11	1	43	202	11	50	39	-30.1	129.0	-136.7	-22.9	-30.4	102.5	265	0	59	
ATLAS	MAS	92	4	2	12	1	0	8	22	47	20	-45.9	90.0	-90.0	-16.1	-32.6	101.3				92.9
UARS	HALOE	92	4	2	11	33	43	202	12	22	39	56.3	220.4	-43.4	-22.9	70.3	263.0	165	1	16	
ATLAS	MAS	92	4	2	12	50	26	8	23	36	46	54.5	280.7	-90.0	-16.1	68.9	264.6				73.2

Table 7. ATLAS SSBUV coincident with UARS HALOE.

sat.	instrument	gmt yr mo da hr mn sc	time into mission da hr mn sc	sub satellite lat lon	viewing angle beta alpha	observed point lat lon	miss dist km	miss time hr mn	solar zenith angle
UARS	HALOE	92 4 1 1 19 26	201 2 8 23	-35.5 276.1	-143.3 -22.9	-36.6 247.7	211	0 1	88.8
ATLAS	SSBUV	92 4 1 1 20 30	7 12 6 50	-37.8 246.4	0.0 -90.0	-37.8 245.8			
UARS	HALOE	92 4 1 2 55 44	201 3 44 40	-35.3 252.0	-142.9 -22.9	-36.4 223.7	157	0 5	87.9
ATLAS	SSBUV	92 4 1 2 50 36	7 13 36 56	-37.1 222.7	0.0 -90.0	-37.1 222.2			
UARS	HALOE	92 4 1 4 32 1	201 5 20 58	-35.0 227.8	-142.6 -22.9	-36.1 199.6	102	0 11	87.0
ATLAS	SSBUV	92 4 1 4 20 42	7 15 7 2	-36.5 199.1	0.0 -90.0	-36.5 198.6			
UARS	HALOE	92 4 1 6 8 19	201 6 57 15	-34.8 203.7	-142.3 -22.9	-35.8 175.5	51	0 17	86.0
ATLAS	SSBUV	92 4 1 5 50 49	7 16 37 9	-35.9 175.5	0.0 -90.0	-35.9 175.0			
UARS	HALOE	92 4 1 7 44 37	201 8 33 32	-34.6 179.5	-142.0 -22.9	-35.5 151.5	37	0 23	85.1
ATLAS	SSBUV	92 4 1 7 20 55	7 18 7 15	-35.2 151.9	0.0 -90.0	-35.2 151.4			
UARS	HALOE	92 4 1 9 20 54	201 10 9 51	-34.3 155.4	-141.7 -22.9	-35.3 127.4	85	0 29	84.2
ATLAS	SSBUV	92 4 1 8 51 2	7 19 37 22	-34.6 128.3	0.0 -90.0	-34.6 127.8			
UARS	HALOE	92 4 1 10 57 12	201 11 46 8	-34.1 131.2	-141.4 -22.9	-35.0 103.4	143	0 36	83.2
ATLAS	SSBUV	92 4 1 10 21 8	7 21 7 28	-33.9 104.7	0.0 -90.0	-33.9 104.2			
UARS	HALOE	92 4 1 12 33 30	201 13 22 26	-33.8 107.1	-141.1 -22.9	-34.7 79.3	204	0 42	82.3
ATLAS	SSBUV	92 4 1 11 51 15	7 22 37 35	-33.3 81.2	0.0 -90.0	-33.3 80.7			
UARS	HALOE	92 4 1 14 9 48	201 14 58 43	-33.6 82.9	-140.8 -22.9	-34.4 55.2	266	0 48	82.1
ATLAS	SSBUV	92 4 1 13 21 36	8 0 7 56	-33.4 58.3	0.0 -90.0	-33.4 57.8			
UARS	HALOE	92 4 1 15 46 5	201 16 35 1	-33.3 58.8	-140.4 -22.9	-34.1 31.2	329	0 54	81.1
ATLAS	SSBUV	92 4 1 14 51 43	8 1 38 3	-32.7 34.8	0.0 -90.0	-32.7 34.3			
UARS	HALOE	92 4 1 17 22 23	201 18 11 20	-33.1 34.6	-140.1 -22.9	-33.8 7.1	393	1 0	80.2
ATLAS	SSBUV	92 4 1 16 21 49	8 3 8 9	-32.0 11.2	0.0 -90.0	-32.0 10.7			
UARS	HALOE	92 4 1 18 58 41	201 19 47 37	-32.8 10.5	-139.8 -22.9	-33.5 343.0	459	1 6	79.2
ATLAS	SSBUV	92 4 1 17 51 55	8 4 38 15	-31.4 347.7	0.0 -90.0	-31.4 347.2			
UARS	HALOE	92 4 2 15 50 39	202 16 39 36	-29.2 56.6	-135.7 -22.9	-29.5 30.3	445	0 53	76.0
ATLAS	SSBUV	92 4 2 14 56 41	9 1 43 1	-32.0 27.2	0.0 -90.0	-32.0 26.7			

Table 8. ATLAS MAS-R coincident with UARS HALOE.

sat.	instrument	gmt yr	mo	da	hr	mn	sc	time into mission da	hr	mn	sc	sub satellite lat	lon	viewing angle beta	alpha	observed point lat	lon	miss dist km	time hr	mn	solar zenith angle
UARS	HALOE	92	3	24	13	37	28	193	14	26	24	-51.1	102.9	-178.5	-22.9	-56.4	64.7	18	2	3	
ATLAS	MAS-R	92	3	24	15	40	45	0	2	27	5	-45.1	83.1	90.0	-16.2	-56.4	64.4				122.3
UARS	HALOE	92	3	24	15	13	43	193	16	2	39	-51.0	78.7	-178.2	-22.9	-56.3	40.6	63	1	57	
ATLAS	MAS-R	92	3	24	17	11	12	0	3	57	32	-45.2	60.2	90.0	-16.2	-56.5	41.5				122.2
UARS	HALOE	92	3	24	16	49	58	193	17	38	54	-51.0	54.6	-177.9	-22.9	-56.1	16.5	88	1	51	
ATLAS	MAS-R	92	3	24	18	41	25	0	5	27	45	-44.6	36.4	90.0	-16.2	-55.8	17.8				121.8
UARS	HALOE	92	3	24	18	26	14	193	19	15	10	-50.9	30.4	-177.5	-22.9	-56.0	352.4	144	1	45	
ATLAS	MAS-R	92	3	24	20	11	37	0	6	57	57	-44.1	12.5	90.0	-16.2	-55.1	354.0				121.3
UARS	HALOE	92	3	24	20	2	29	193	20	51	25	-50.8	6.2	-177.2	-22.9	-55.9	328.3	197	1	39	
ATLAS	MAS-R	92	3	24	21	42	5	0	8	28	25	-44.2	349.7	90.0	-16.2	-55.2	331.2				121.2
UARS	HALOE	92	3	24	21	38	44	193	22	27	40	-50.7	342.0	-176.9	-22.9	-55.8	304.2	249	1	33	
ATLAS	MAS-R	92	3	24	23	12	17	0	9	58	37	-43.6	325.9	90.0	-16.2	-54.5	307.4				120.7
UARS	HALOE	92	3	24	23	14	59	194	0	3	55	-50.6	317.9	-176.6	-22.9	-55.7	280.1	309	1	27	
ATLAS	MAS-R	92	3	25	0	42	44	0	11	29	4	-43.7	303.1	90.0	-16.2	-54.6	284.6				120.6
UARS	HALOE	92	3	25	0	51	15	194	1	40	11	-50.5	293.7	-176.3	-22.9	-55.5	256.0	361	1	21	
ATLAS	MAS-R	92	3	25	2	12	57	0	12	59	17	-43.1	279.3	90.0	-16.2	-53.9	260.9				120.1
UARS	HALOE	92	3	25	2	27	30	194	3	16	26	-50.5	269.5	-176.0	-22.9	-55.4	231.9	420	1	15	
ATLAS	MAS-R	92	3	25	3	43	9	0	14	29	29	-42.5	255.5	90.0	-16.2	-53.2	237.2				119.6
UARS	HALOE	92	3	25	4	3	45	194	4	52	41	-50.4	245.3	-175.7	-22.9	-55.3	207.8	477	1	9	
ATLAS	MAS-R	92	3	25	5	13	37	0	15	59	57	-42.6	232.6	90.0	-16.2	-53.4	214.4				119.5
UARS	HALOE	92	3	25	12	5	2	194	12	53	57	-49.9	124.5	-174.1	-22.9	-54.7	87.4	481	2	12	
ATLAS	MAS-R	92	3	25	14	17	21	1	1	3	41	-45.7	99.6	90.0	-16.2	-57.1	81.0				119.9
UARS	HALOE	92	3	25	13	41	17	194	14	30	13	-49.8	100.3	-173.8	-22.9	-54.5	63.3	435	2	6	
ATLAS	MAS-R	92	3	25	15	47	49	1	2	34	9	-45.8	76.8	90.0	-16.2	-57.2	58.1				119.8
UARS	HALOE	92	3	25	15	17	33	194	16	6	29	-49.7	76.1	-173.5	-22.9	-54.4	39.2	384	2	0	
ATLAS	MAS-R	92	3	25	17	18	1	1	4	4	21	-45.2	52.9	90.0	-16.2	-56.5	34.3				119.3
UARS	HALOE	92	3	25	16	53	48	194	17	42	45	-49.7	51.9	-173.1	-22.9	-54.3	15.1	336	1	54	
ATLAS	MAS-R	92	3	25	18	48	14	1	5	34	34	-44.7	29.1	90.0	-16.2	-55.8	10.6				118.8
UARS	HALOE	92	3	25	18	30	4	194	19	18	59	-49.6	27.8	-172.8	-22.9	-54.1	351.0	288	1	48	
ATLAS	MAS-R	92	3	25	20	18	41	1	7	5	1	-44.8	6.3	90.0	-16.2	-55.9	347.7				118.6
UARS	HALOE	92	3	25	20	6	19	194	20	55	15	-49.5	3.6	-172.5	-22.9	-54.0	326.9	233	1	42	
ATLAS	MAS-R	92	3	25	21	48	53	1	8	35	13	-44.2	342.4	90.0	-16.2	-55.3	324.0				118.1

Table 8. Continued.

sat.	instrument	gmt yr mo da hr mn sc	time into mission da hr mn sc	sub satellite lat lon	viewing angle beta alpha	observed point lat lon	miss dist km	miss time hr mn	solar zenith angle
UARS	HALOE	92 3 25 21 42 34	194 22 31 30	-49.4 339.4	-172.2 -22.9	-53.9 302.8	183	1 36	
ATLAS	MAS-R	92 3 25 23 19 6	1 10 5 26	-43.6 318.6	90.0 -16.2	-54.6 300.2			117.6
UARS	HALOE	92 3 25 23 18 50	195 0 7 46	-49.3 315.2	-171.9 -22.9	-53.8 278.7	133	1 30	
ATLAS	MAS-R	92 3 26 0 49 33	1 11 35 53	-43.7 295.8	90.0 -16.2	-54.7 277.4			117.4
UARS	HALOE	92 3 26 0 55 5	195 1 44 1	-49.2 291.1	-171.6 -22.9	-53.6 254.6	73	1 24	
ATLAS	MAS-R	92 3 26 2 19 46	1 13 6 6	-43.1 272.0	90.0 -16.2	-54.0 253.7			116.9
UARS	HALOE	92 3 26 2 31 21	195 3 20 16	-49.1 266.9	-171.2 -22.9	-53.5 230.5	40	1 18	
ATLAS	MAS-R	92 3 26 3 49 58	1 14 36 18	-42.6 248.2	90.0 -16.2	-53.3 230.0			116.3
UARS	HALOE	92 3 26 4 7 36	195 4 56 32	-49.0 242.7	-170.9 -22.9	-53.3 206.4	48	1 12	
ATLAS	MAS-R	92 3 26 5 20 25	1 16 6 45	-42.6 225.3	90.0 -16.2	-53.4 207.2			116.1
UARS	HALOE	92 3 26 5 43 52	195 6 32 48	-48.9 218.5	-170.6 -22.9	-53.2 182.3	94	1 6	
ATLAS	MAS-R	92 3 26 6 50 38	1 17 36 58	-42.1 201.5	90.0 -16.2	-52.7 183.5			115.6
UARS	HALOE	92 3 26 7 20 7	195 8 9 4	-48.8 194.4	-170.3 -22.9	-53.1 158.3	159	1 0	
ATLAS	MAS-R	92 3 26 8 20 50	1 19 7 10	-41.5 177.8	90.0 -16.2	-52.0 159.8			115.0
UARS	HALOE	92 3 26 8 56 23	195 9 45 19	-48.7 170.2	-170.0 -22.9	-52.9 134.2	211	0 54	
ATLAS	MAS-R	92 3 26 9 51 18	1 20 37 38	-41.6 154.9	90.0 -16.2	-52.1 137.0			114.8
UARS	HALOE	92 3 26 10 32 38	195 11 21 34	-48.6 146.0	-169.7 -22.9	-52.8 110.1	271	0 48	
ATLAS	MAS-R	92 3 26 11 21 30	1 22 7 50	-41.0 131.2	90.0 -16.2	-51.4 113.3			114.2
UARS	HALOE	92 3 26 12 8 54	195 12 57 49	-48.5 121.8	-169.4 -22.9	-52.7 86.0	332	0 43	
ATLAS	MAS-R	92 3 26 12 51 57	1 23 38 17	-41.0 108.4	90.0 -16.2	-51.5 90.5			114.0
UARS	HALOE	92 3 26 13 45 9	195 14 34 5	-48.4 97.7	-169.0 -22.9	-52.5 61.9	391	0 37	
ATLAS	MAS-R	92 3 26 14 22 10	2 1 8 30	-40.4 84.6	90.0 -16.2	-50.8 66.9			113.4
UARS	HALOE	92 3 26 15 21 25	195 16 10 21	-48.3 73.5	-168.7 -22.9	-52.4 37.8	455	0 30	
ATLAS	MAS-R	92 3 26 15 52 22	2 2 38 42	-39.8 60.9	90.0 -16.2	-50.1 43.3			112.7
UARS	HALOE	92 3 27 4 11 30	196 5 0 25	-47.4 240.1	-166.2 -22.9	-51.2 205.1	429	1 15	
ATLAS	MAS-R	92 3 27 5 27 14	2 16 13 34	-42.7 218.0	90.0 -16.2	-53.5 200.0			112.7
UARS	HALOE	92 3 27 5 47 45	196 6 36 41	-47.4 216.0	-166.1 -22.9	-51.2 181.0	368	1 9	
ATLAS	MAS-R	92 3 27 6 57 27	2 17 43 47	-42.1 194.2	90.0 -16.2	-52.8 176.3			112.0
UARS	HALOE	92 3 27 5 47 46	196 6 36 42	-47.3 216.0	-165.9 -22.9	-51.0 181.1	334	1 7	
ATLAS	MAS-R	92 3 27 6 55 30	2 17 41 50	-41.7 194.5	90.0 -16.2	-52.3 176.7			112.0
UARS	HALOE	92 3 27 7 24 1	196 8 12 57	-47.2 191.8	-165.6 -22.9	-50.9 157.0	274	1 1	
ATLAS	MAS-R	92 3 27 8 25 56	2 19 12 16	-41.8 171.7	90.0 -16.2	-52.4 153.8			111.8

Table 8. Continued.

sat.	instrument	gmt yr	mo	da	hr	mn	sc	time into mission da	hr	mn	sc	sub satellite lat	lon	viewing angle beta	alpha	observed point lat	lon	miss dist km	time hr	mn	solar zenith angle
UARS	HALOE	92	3	27	9	0	17	196	9	49	13	-47.1	167.6	-165.3	-22.9	-50.7	132.9	217	0	55	
ATLAS	MAS-R	92	3	27	9	56	6	2	20	42	26	-41.2	147.9	90.0	-16.2	-51.7	130.2				111.1
UARS	HALOE	92	3	27	10	36	33	196	11	25	28	-46.9	143.4	-165.0	-22.9	-50.6	108.8	164	0	49	
ATLAS	MAS-R	92	3	27	11	26	17	2	22	12	37	-40.6	124.2	90.0	-16.2	-51.0	106.6				110.5
UARS	HALOE	92	3	27	12	12	48	196	13	1	44	-46.8	119.3	-164.6	-22.9	-50.4	84.7	102	0	43	
ATLAS	MAS-R	92	3	27	12	56	42	2	23	43	2	-40.7	101.3	90.0	-16.2	-51.1	83.7				110.3
UARS	HALOE	92	3	27	13	49	4	196	14	38	0	-46.7	95.1	-164.3	-22.9	-50.3	60.6	40	0	37	
ATLAS	MAS-R	92	3	27	14	26	53	3	1	13	13	-40.1	77.6	90.0	-16.2	-50.4	60.1				109.6
UARS	HALOE	92	3	27	15	25	20	196	16	14	16	-46.6	70.9	-164.0	-22.9	-50.1	36.6	48	0	31	
ATLAS	MAS-R	92	3	27	15	57	3	3	2	43	23	-39.5	53.9	90.0	-16.2	-49.7	36.5				108.9
UARS	HALOE	92	3	27	17	1	35	196	17	50	31	-46.5	46.8	-163.7	-22.9	-50.0	12.5	86	0	25	
ATLAS	MAS-R	92	3	27	17	27	29	3	4	13	49	-39.6	31.1	90.0	-16.2	-49.8	13.7				108.7
UARS	HALOE	92	3	27	18	37	51	196	19	26	47	-46.3	22.6	-163.4	-22.9	-49.8	348.4	146	0	19	
ATLAS	MAS-R	92	3	27	18	57	39	3	5	43	59	-38.9	7.4	90.0	-16.2	-49.1	350.1				108.0
UARS	HALOE	92	3	27	20	14	7	196	21	3	3	-46.2	358.4	-163.1	-22.9	-49.6	324.3	214	0	13	
ATLAS	MAS-R	92	3	27	20	27	50	3	7	14	10	-38.3	343.7	90.0	-16.2	-48.4	326.5				107.3
UARS	HALOE	92	3	27	21	50	23	196	22	39	18	-46.1	334.2	-162.8	-22.9	-49.5	300.2	274	0	7	
ATLAS	MAS-R	92	3	27	21	58	15	3	8	44	35	-38.4	320.9	90.0	-16.2	-48.5	303.7				107.1
UARS	HALOE	92	3	27	23	26	38	197	0	15	34	-46.0	310.1	-162.4	-22.9	-49.3	276.2	339	0	1	
ATLAS	MAS-R	92	3	27	23	28	26	3	10	14	46	-37.8	297.2	90.0	-16.2	-47.8	280.1				106.4
UARS	HALOE	92	3	28	1	2	54	197	1	51	50	-45.8	285.9	-162.1	-22.9	-49.2	252.1	408	0	4	
ATLAS	MAS-R	92	3	28	0	58	51	3	11	45	11	-37.9	274.4	90.0	-16.2	-47.9	257.3				106.2
UARS	HALOE	92	3	28	2	39	10	197	3	28	6	-45.7	261.7	-161.8	-22.9	-49.0	228.0	472	0	10	
ATLAS	MAS-R	92	3	28	2	29	2	3	13	15	22	-37.2	250.7	90.0	-16.2	-47.2	233.7				105.4
UARS	HALOE	92	3	28	15	29	17	197	16	18	13	-44.6	68.4	-159.3	-22.9	-47.6	35.4	494	0	34	
ATLAS	MAS-R	92	3	28	16	3	21	4	2	49	41	-39.5	46.8	90.0	-16.2	-49.7	29.4				105.0
UARS	HALOE	92	3	28	17	5	33	197	17	54	30	-44.5	44.2	-159.0	-22.9	-47.5	11.3	435	0	28	
ATLAS	MAS-R	92	3	28	17	33	47	4	4	20	7	-39.6	23.9	90.0	-16.2	-49.8	6.6				104.9
UARS	HALOE	92	3	28	18	41	49	197	19	30	46	-44.4	20.0	-158.7	-22.9	-47.3	347.2	373	0	22	
ATLAS	MAS-R	92	3	28	19	3	57	4	5	50	17	-39.0	0.2	90.0	-16.2	-49.1	343.0				104.1
UARS	HALOE	92	3	28	20	18	5	197	21	7	1	-44.2	355.9	-158.3	-22.9	-47.1	323.1	312	0	16	
ATLAS	MAS-R	92	3	28	20	34	8	4	7	20	28	-38.4	336.5	90.0	-16.2	-48.4	319.4				103.3

Table 8. Continued.

sat.	instrument	gmt yr mo da hr mn sc	time into mission da hr mn sc	sub satellite lat lon	viewing angle beta alpha	observed point lat lon	miss dist km	miss time hr mn	solar zenith angle
UARS	HALOE	92 3 28 21 54 21	197 22 43 17	-44.1 331.7	-158.0 -22.9	-46.9 299.1	253	0 9	
ATLAS	MAS-R	92 3 28 22 4 18	4 8 50 38	-37.7 312.9	90.0 -16.2	-47.7 295.9			102.5
UARS	HALOE	92 3 28 23 30 38	198 0 19 34	-43.9 307.5	-157.7 -22.9	-46.7 275.0	189	0 4	
ATLAS	MAS-R	92 3 28 23 34 44	4 10 21 4	-37.8 290.0	90.0 -16.2	-47.8 273.0			102.3
UARS	HALOE	92 3 29 1 6 54	198 1 55 50	-43.8 283.4	-157.4 -22.9	-46.6 250.9	122	0 1	
ATLAS	MAS-R	92 3 29 1 4 54	4 11 51 14	-37.2 266.4	90.0 -16.2	-47.1 249.5			101.5
UARS	HALOE	92 3 29 2 43 10	198 3 32 6	-43.6 259.2	-157.1 -22.9	-46.4 226.8	64	0 8	
ATLAS	MAS-R	92 3 29 2 35 4	4 13 21 24	-36.6 242.7	90.0 -16.2	-46.4 226.0			100.7
UARS	HALOE	92 3 29 4 19 26	198 5 8 21	-43.5 235.0	-156.8 -22.9	-46.2 202.7	44	0 13	
ATLAS	MAS-R	92 3 29 4 5 30	4 14 51 50	-36.7 219.9	90.0 -16.2	-46.5 203.1			100.6
UARS	HALOE	92 3 29 5 55 42	198 6 44 38	-43.3 210.9	-156.5 -22.9	-46.0 178.7	76	0 20	
ATLAS	MAS-R	92 3 29 5 35 40	4 16 22 0	-36.0 196.3	90.0 -16.2	-45.8 179.6			99.7
UARS	HALOE	92 3 29 7 31 58	198 8 20 54	-43.2 186.7	-156.1 -22.9	-45.8 154.6	144	0 26	
ATLAS	MAS-R	92 3 29 7 5 51	4 17 52 11	-35.4 172.6	90.0 -16.2	-45.1 156.1			98.9
UARS	HALOE	92 3 29 9 8 14	198 9 57 10	-43.0 162.5	-155.8 -22.9	-45.6 130.5	218	0 32	
ATLAS	MAS-R	92 3 29 8 36 1	4 19 22 21	-34.7 149.0	90.0 -16.2	-44.3 132.6			98.1
UARS	HALOE	92 3 29 10 44 31	198 11 33 27	-42.9 138.4	-155.5 -22.9	-45.4 106.4	282	0 38	
ATLAS	MAS-R	92 3 29 10 6 27	4 20 52 47	-34.8 126.2	90.0 -16.2	-44.4 109.7			97.9
UARS	HALOE	92 3 29 12 20 47	198 13 9 43	-42.7 114.2	-155.2 -22.9	-45.2 82.4	352	0 44	
ATLAS	MAS-R	92 3 29 11 36 37	4 22 22 57	-34.2 102.6	90.0 -16.2	-43.7 86.3			97.1
UARS	HALOE	92 3 29 13 57 3	198 14 46 0	-42.6 90.0	-154.9 -22.9	-45.0 58.3	425	0 50	
ATLAS	MAS-R	92 3 29 13 6 48	4 23 53 8	-33.5 79.0	90.0 -16.2	-43.0 62.8			96.2
UARS	HALOE	92 3 30 7 36 4	199 8 25 1	-40.7 184.2	-151.4 -22.9	-42.8 153.5	472	0 25	
ATLAS	MAS-R	92 3 30 7 10 28	5 17 56 48	-35.1 165.7	90.0 -16.1	-44.7 148.3			93.6
UARS	HALOE	92 3 30 9 12 21	199 10 1 16	-40.6 160.1	-151.1 -22.9	-42.6 129.4	408	0 31	
ATLAS	MAS-R	92 3 30 8 40 34	5 19 26 54	-34.5 142.1	90.0 -16.1	-44.0 124.8			92.7
UARS	HALOE	92 3 30 10 48 37	199 11 37 33	-40.4 135.9	-150.8 -22.9	-42.4 105.3	339	0 37	
ATLAS	MAS-R	92 3 30 10 10 55	5 20 57 15	-34.6 119.3	90.0 -16.1	-44.1 101.9			92.6
UARS	HALOE	92 3 30 12 24 54	199 13 13 51	-40.2 111.8	-150.5 -22.9	-42.2 81.3	269	0 43	
ATLAS	MAS-R	92 3 30 11 41 2	5 22 27 22	-33.9 95.7	90.0 -16.1	-43.4 78.4			91.7
UARS	HALOE	92 3 30 14 1 11	199 14 50 6	-40.0 87.6	-150.2 -22.9	-41.9 57.2	200	0 50	
ATLAS	MAS-R	92 3 30 13 11 8	5 23 57 28	-33.3 72.1	90.0 -16.1	-42.7 55.0			90.8

Table 8. Continued.

sat.	instrument	gmt yr	mo	da	hr	mn	sc	time into mission da	hr	mn	sc	sub satellite lat	lon	viewing angle beta	alpha	observed point lat	lon	miss dist km	time hr	mn	solar zenith angle
UARS	HALOE	92	3	30	15	37	28	199	16	26	23	-39.8	63.4	-149.8	-22.9	-41.7	33.1	135	0	56	
ATLAS	MAS-R	92	3	30	14	41	15	6	1	27	35	-32.6	48.6	90.0	-16.1	-42.0	31.5				89.9
UARS	HALOE	92	3	30	17	13	44	199	18	2	40	-39.6	39.3	-149.5	-22.9	-41.5	9.1	70	1	2	
ATLAS	MAS-R	92	3	30	16	11	36	6	2	57	56	-32.7	25.7	90.0	-16.1	-42.1	8.7				89.7
UARS	HALOE	92	3	30	18	50	1	199	19	38	57	-39.5	15.1	-149.2	-22.9	-41.3	345.0	21	1	8	
ATLAS	MAS-R	92	3	30	17	41	43	6	4	28	3	-32.0	2.2	90.0	-16.1	-41.3	345.2				88.8
UARS	HALOE	92	3	30	20	26	18	199	21	15	14	-39.3	350.9	-148.9	-22.9	-41.1	320.9	88	1	14	
ATLAS	MAS-R	92	3	30	19	11	49	6	5	58	9	-31.4	338.7	90.0	-16.1	-40.6	321.8				87.9
UARS	HALOE	92	3	30	22	2	35	199	22	51	30	-39.1	326.8	-148.6	-22.9	-40.8	296.9	165	1	20	
ATLAS	MAS-R	92	3	30	20	41	56	6	7	28	16	-30.7	315.1	90.0	-16.1	-39.9	298.4				87.0
UARS	HALOE	92	3	30	23	38	52	200	0	27	47	-38.9	302.6	-148.3	-22.9	-40.6	272.8	241	1	26	
ATLAS	MAS-R	92	3	30	22	12	17	6	8	58	37	-30.8	292.3	90.0	-16.1	-40.0	275.5				86.8
UARS	HALOE	92	3	31	1	15	8	200	2	4	4	-38.7	278.5	-148.0	-22.9	-40.4	248.7	313	1	32	
ATLAS	MAS-R	92	3	30	23	42	24	6	10	28	44	-30.1	268.8	90.0	-16.1	-39.3	252.1				85.9
UARS	HALOE	92	3	31	2	51	25	200	3	40	21	-38.5	254.3	-147.7	-22.9	-40.1	224.7	389	1	38	
ATLAS	MAS-R	92	3	31	1	12	30	6	11	58	50	-29.4	245.3	90.0	-16.1	-38.5	228.7				85.0
UARS	HALOE	92	3	31	4	27	42	200	5	16	38	-38.3	230.2	-147.3	-22.9	-39.9	200.6	467	1	45	
ATLAS	MAS-R	92	3	31	2	42	37	6	13	28	57	-28.7	221.8	90.0	-16.1	-37.8	205.3				84.0
UARS	HALOE	92	3	31	22	6	51	200	22	55	47	-36.0	324.4	-143.9	-22.9	-37.2	295.9	484	1	19	
ATLAS	MAS-R	92	3	31	20	46	54	7	7	33	14	-30.0	307.6	90.0	-16.1	-39.1	290.9				81.7
UARS	HALOE	92	3	31	23	43	9	201	0	32	6	-35.7	300.3	-143.6	-22.9	-36.9	271.8	413	1	26	
ATLAS	MAS-R	92	3	31	22	17	1	7	9	3	21	-29.3	284.1	90.0	-16.1	-38.4	267.5				80.8
UARS	HALOE	92	4	1	1	19	26	201	2	8	23	-35.5	276.1	-143.3	-22.9	-36.6	247.7	341	1	32	
ATLAS	MAS-R	92	3	31	23	47	7	7	10	33	27	-28.6	260.6	90.0	-16.1	-37.7	244.1				79.9
UARS	HALOE	92	4	1	2	55	44	201	3	44	40	-35.3	252.0	-142.9	-22.9	-36.4	223.7	266	1	38	
ATLAS	MAS-R	92	4	1	1	17	29	7	12	3	49	-28.7	237.7	90.0	-16.1	-37.8	221.2				79.7
UARS	HALOE	92	4	1	4	32	1	201	5	20	58	-35.0	227.8	-142.6	-22.9	-36.1	199.6	189	1	44	
ATLAS	MAS-R	92	4	1	2	47	35	7	13	33	55	-28.0	214.2	90.0	-16.1	-37.0	197.8				78.7
UARS	HALOE	92	4	1	6	8	19	201	6	57	15	-34.8	203.7	-142.3	-22.9	-35.8	175.5	112	1	50	
ATLAS	MAS-R	92	4	1	4	17	42	7	15	4	2	-27.3	190.7	90.0	-16.1	-36.3	174.4				77.8
UARS	HALOE	92	4	1	7	44	37	201	8	33	32	-34.6	179.5	-142.0	-22.9	-35.5	151.5	38	1	56	
ATLAS	MAS-R	92	4	1	5	47	48	7	16	34	8	-26.6	167.3	90.0	-16.1	-35.6	151.1				76.8

Table 8. Concluded.

sat.	instrument	gmt yr	mo	da	hr	mn	sc	time into mission da	hr	mn	sc	sub satellite lat	lon	viewing angle beta	alpha	observed point lat	lon	miss dist km	time hr	mn	solar zenith angle
UARS	HALOE	92	4	1	9	20	54	201	10	9	51	-34.3	155.4	-141.7	-22.9	-35.3	127.4	52	2	2	
ATLAS	MAS-R	92	4	1	7	17	55	7	18	4	15	-25.9	143.8	90.0	-16.1	-34.8	127.7				75.8
UARS	HALOE	92	4	1	10	57	12	201	11	46	8	-34.1	131.2	-141.4	-22.9	-35.0	103.4	130	2	9	
ATLAS	MAS-R	92	4	1	8	48	1	7	19	34	21	-25.2	120.3	90.0	-16.1	-34.1	104.3				74.9
UARS	HALOE	92	4	1	12	33	30	201	13	22	26	-33.8	107.1	-141.1	-22.9	-34.7	79.3	203	2	15	
ATLAS	MAS-R	92	4	1	10	18	22	7	21	4	42	-25.4	97.5	90.0	-16.1	-34.2	81.4				74.7
UARS	HALOE	92	4	1	14	9	48	201	14	58	43	-33.6	82.9	-140.8	-22.9	-34.4	55.2	280	2	21	
ATLAS	MAS-R	92	4	1	11	48	29	7	22	34	49	-24.7	74.0	90.0	-16.1	-33.5	58.1				73.7
UARS	HALOE	92	4	1	15	46	5	201	16	35	1	-33.3	58.8	-140.4	-22.9	-34.1	31.2	361	2	27	
ATLAS	MAS-R	92	4	1	13	18	35	8	0	4	55	-24.0	50.6	90.0	-16.1	-32.8	34.7				72.8
UARS	HALOE	92	4	1	17	22	23	201	18	11	20	-33.1	34.6	-140.1	-22.9	-33.8	7.1	442	2	33	
ATLAS	MAS-R	92	4	1	14	48	42	8	1	35	2	-23.3	27.1	90.0	-16.1	-32.0	11.3				71.8
UARS	HALOE	92	4	2	14	14	20	202	15	3	16	-29.5	80.7	-136.1	-22.9	-29.8	54.3	462	2	21	
ATLAS	MAS-R	92	4	2	11	53	13	8	22	39	33	-23.1	65.9	90.0	-16.1	-31.9	50.2				67.5
UARS	HALOE	92	4	2	15	50	39	202	16	39	36	-29.2	56.6	-135.7	-22.9	-29.5	30.3	384	2	27	
ATLAS	MAS-R	92	4	2	13	23	19	9	0	9	39	-22.4	42.5	90.0	-16.1	-31.1	26.8				66.5

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Edwin F. Harrison, Fred M. Denn, and Gary G. Gibson

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The first ATmospheric Laboratory for Applications and Science (ATLAS-1) mission was flown aboard the Space Shuttle from March 24 to April 2, 1992. The ATLAS-1 instruments provided a large number of measurements which were coincident with observations from experiments on the Upper Atmosphere Research Satellite (UARS). During the ATLAS-1 mission, simulations were performed to predict when and where coincident measurements between ATLAS and UARS instruments would occur. These predictions were used to develop instrument operation schedules to maximize the correlative opportunities between the two satellites. Results of the simulations provide valuable information for the ATLAS and UARS scientists to compare measurements between various instruments on the two satellites.

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